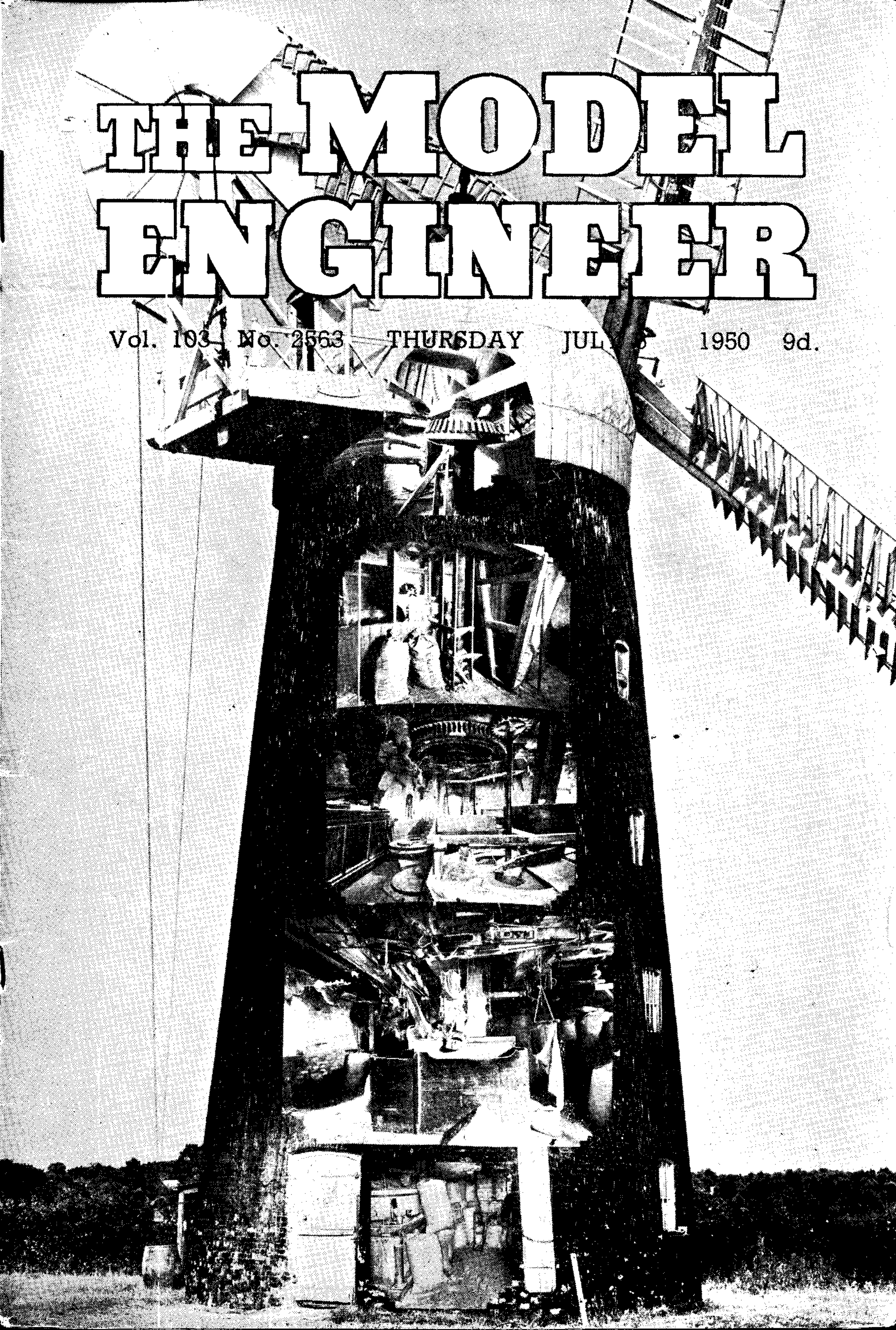
THE MODEL ENGINEER

Vol. 103 No. 2563 THURSDAY JULY 6 1950 9d.



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

6TH JULY 1950 VOL. 103 NO. 2563

SMOKE RINGS

Our Cover Picture

● THE MODERN art of the composite photograph, or "photomontage," as it is termed, offers many possibilities for the illustration of technical subjects. One of the most remarkable examples of this art which we have seen is the photograph shown on this week's cover, in which six separate exterior and interior photographs of a full-sized windmill have been skilfully combined in juxtaposition to give the effect of a sectional model. It is the work of Mr. Gerald F. Lambert, F.R.P.S., A. Inst. B.P., chairman of the Bury St. Edmunds Model Engineering Society, and the subject is the Pakenham Mill, just outside Ixworth on the Great Yarmouth road. This is one of the few remaining working windmills in the country, and the owner, Mr. Bryant, takes a great pride in it. A pair of sails were lost in a gale two or three years ago, since when it has been working with only one pair, due to difficulty in obtaining suitable timber for replacing the broken parts; but it has now been stripped down and repair work started. One of the new timbers put in to carry the neck bearing is a piece of African oak measuring 12 ft. long, 3 ft. wide and 9 in. thick, and weighing three-quarters of a ton. Mr. Lambert gives an interesting account of his experiences in taking the photographs of the mill, which was certainly no mean adventure. He states :—

"The exterior was taken first, and in order to get the effect of the sails being mounted on the wind shaft, it was necessary to select the viewpoint very carefully. Owing to the confined working space I could only take it when the mill stood facing a certain direction; as it was not pointing that way when I arrived, I got the miller's permission to wind it 'out of the wind.' This is done by hand after disconnecting the 'fly,' and can only be safely done when there is no wind. One of the worst things that can happen to a windmill is to get a strong tail wind If such a thing happens, there is a good chance that both cap and sails will be blown right off.

"After the exterior had been taken, I climbed up and connected the fly again. My reward was a terrific clout on the head which all but laid me out. A slight breeze had sprung up, and she started to turn into the wind again. Unfortunately for me I did not remove my head quickly

enough! But that was not all! The loose ladder leading from the top floor to the fly had fallen down due to the rotation of the cap, and after it had come to rest I started to climb down via the main gearing and the sack hoist. Now the latter is operated by means of a cone clutch at the top end of the vertical main shaft, and I could not remember whether this was engaged or not. I therefore tried it with my foot in order to see if I could turn it. I could not do so, and I therefore decided that it would be safe to stand on the roller with both feet. No sooner had I done this than the roller shot round, launching me into space. I had the sense to throw out both arms, and I suddenly stopped with a most sickening jerk which nearly wrenched my arms from their sockets. I was then swinging in mid-air with one arm over the roller, the other over the hand-rail, and not one open trap door beneath me—but two!! Had I not flung out both arms pretty smartly, I should have fallen half the height of the tower. I knew quite a bit about windmills when I started the job, but it was nothing to what I knew by the time I reached the ground!!

"Having had more than enough for one day, I decided to defer the interiors until my arms felt as if they really belonged to me, so about a week later I sallied forth. Whether I have succeeded in matching interior with exterior I will leave you to decide. Unfortunately, I could not use any form of portable floodlighting, as current was not available, and flash-powder would not be safe owing to the risk of fire. Flash bulbs had not been invented then (I think), and in any case they would have been useless owing to the small lens apertures at which I was obliged to work. I could therefore only expose by the light from the tiny dirty windows.

"The next job was to scale all the interiors with the exterior, otherwise the machinery would have been out of proportion. Prominent pieces were, therefore measured as also was the exterior, and a 2-ft. 'mock-up' prepared in order to find the snags. It was found necessary to count the rows of bricks on the tower in order to find where the floor levels were, and although the final result is a bit of a freak, I could not think of any other way of doing it. My main object was to produce a record of a fast disappearing landmark, and the five-footer was duly exhibited at Princes Galleries, Piccadilly in 1935. I hope it will now induce some modeller to produce a masterpiece."

Mr. Lambert has a giant enlargement, 5 ft. high, in his studio at Well Street, Bury St. Edmunds, and has expressed his willingness to show this to any readers who may be in that district.

Modelling Railway History

● THERE HAS just been formed a new society which, we think, is likely to be of great interest to everybody who loves the railways and their history. The new society has for its objects, first, the study, acquisition and preservation of information and illustrative or other material relating to all railways of the British Isles and their equipment, up to the dates when they lost their separate identities, either at grouping or at nationalisation, and secondly, the construction and preservation of models of those railways and their equipment. It grew as a result of a meeting convened as far back as March 18th last, when a provisional committee was appointed to draw up a proper constitution as well as broad plans for the future operation and administration of the proposed society's activities. This was duly done, and at a well-attended meeting held at Chessington Zoo on June 3rd last, the final constitution was approved and the executive officers and committee duly elected.

The possibility of finding suitable accommodation as headquarters and meeting-room is being investigated, and means of producing a periodical journal are being vigorously explored. Meanwhile, Monday, October 9th has been fixed for a general meeting to be held at a time and place to be announced later. The hon. secretary is Mr. A. P. Hancox, 30, Gillian Park Road, Sutton, Surrey, who will be pleased to give full information to anybody interested.

We feel that the formation of this society is not only timely, but fills a growing need. Model-makers everywhere are becoming more and more interested in the railways-that-used-to-be. As time goes on, vital information to enable accurate models to be made of all kinds of railway equipment becomes increasingly difficult to obtain; therefore, a society or institution which will collate and preserve such information cannot be too highly commended.

The Hobby was Worth While

● ARISING OUT of our recent paragraph headed "The Worth of a Hobby," a reader who signs himself C. H. T. (a covering note, of course, gave his full name and address) writes: "I consider that to say a hobby is worthless is ridiculous. I started model engineering as a hobby some thirty-eight years ago, and I and my wife and children have all benefited.

"First, when applying for a job, I showed an article that I had made in my workshop, and was soon told, 'Start Monday.' That was thirty years ago, and I am still there.

"Secondly, the firm pays for ideas that improve their manufacturing methods. I experimented with my ideas in my workshop at home; I had four accepted and paid for.

"Thirdly, for several years, I have made toys for my five children who, consequently have *more and better* toys than I could buy.

"Fourthly, several electrical domestic appliances in the home were bought, very much second-hand, overhauled, repaired, sprayed with cellulose and put into service. So my wife benefited.

"Finally, apart from the above, I have spent many thousands of happy hours in my workshop, making models, several of which have earned me diplomas at the 'Model Engineer' Exhibition."

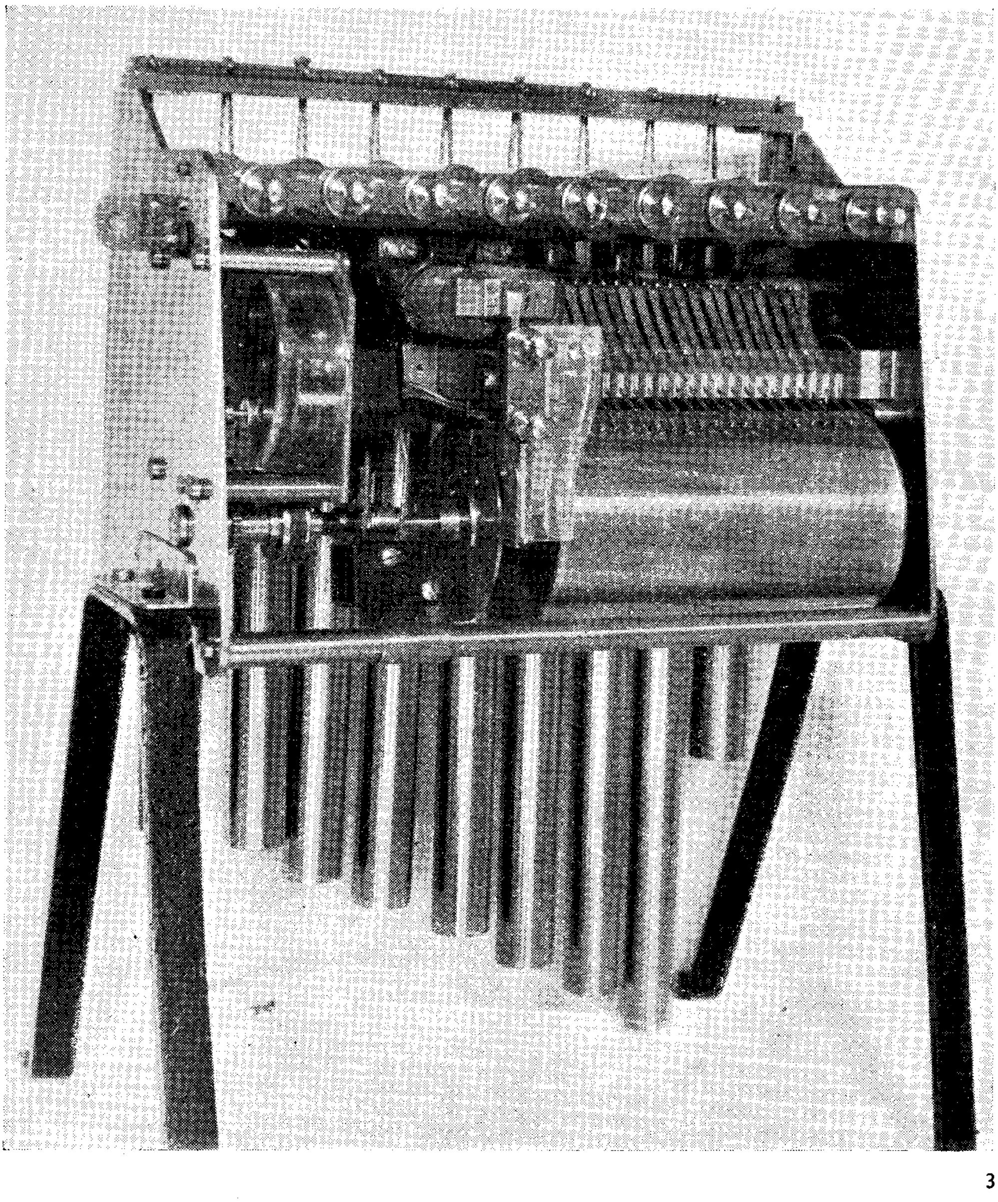
All this certainly makes out a very good case for the worth of model engineering as a hobby, and the letter, naturally, interested us primarily on this account. But we would go so far as to assert that *any* hobby, provided that it gives pleasure, recreation or amusement, and is, of course, strictly within the law, is worth while; and nobody can prove that it is not!

An Electrical Clock Chime

by A. Ashby

HAVING made a Congreve clock, I was considering the making of a suitable chime for it when an article in THE MODEL ENGINEER by H. Stocker Harris (August 12th, 1948) was published describing an improved electric chime he had made. This was based on one published in the book *Electric Clocks and Chimes*, being driven by clockwork and wound by an electrical impulse from the master clock.

I have designed my chime to be motor-operated and have used solenoids in place of magnets for striking the bells. The original idea of the drum covered with acetate film and suitably punched for contacts has been retained.



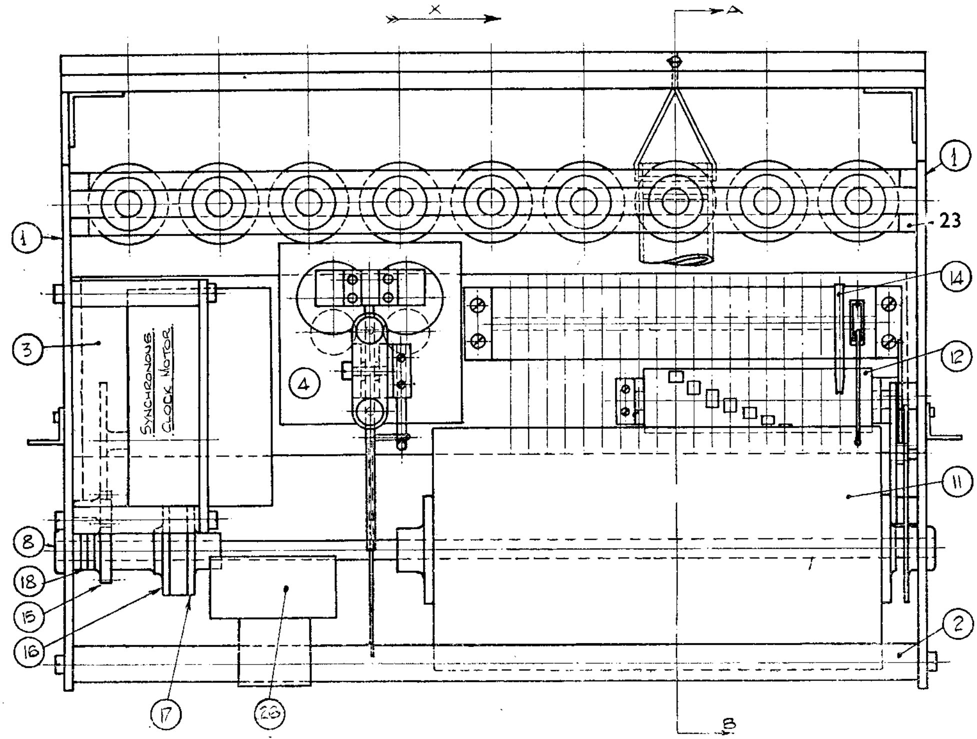


Fig. 1.

The chiming of a clock every quarter of an hour can be too much of a good thing, and so it was decided to make it half-hourly. This would enable a longer chime to be played without making the drum unduly large in diameter. Of course, if desired, the present design could quite easily be altered to suit a quarter chime. The start wheel would have four suitably placed slots in it and a simple switching arrangement could be incorporated to make the quarters optional.

The whole of the mechanism is carried between two brass end plates *1* (Figs. 1 and 2) with stretcher bars *2* and a plate *3* between them. On this plate is mounted a relay *4* operated by an impulse from the clock mechanism every half hour. The relay armature which is pivoted in a suitable bracket at *5* (Fig. 3) and the movement of which is controlled by the adjustable stop-screws *6*, carries at its extremity a piece of flat spring. A coil spring *7* normally pulls this release arm into a slot in a brass disc or stop-wheel mounted on the main drive-shaft *8*. A small insulated pin is also mounted on this release arm and comes between two contact springs or fingers, which are also mounted on the relay armature pivot pillar. These contacts are connected in series with the driving motor and mains, so that when no impulse is going through the relay, the coil spring pulls the release arm and permits it to drop into the slot in the stop wheel and also opens the contacts, thus stopping the motor.

The slots in the stop-wheel are made about $\frac{1}{16}$ in. wide and a brass plate *9* is pivoted and sprung against stops *10* on the side of the wheel, leaving just sufficient room for the flat spring on the release arm to drop in, Fig. 3. As the mechanism will not stop at once, the strain of stopping it suddenly is taken up by the release arm pulling back these spring-loaded plates a fraction of an inch. Also, when the starting impulse comes through and the release arm is lifted rather quickly and released, these plates are pulled back by their springs this fraction of an inch and thus stop the release arm falling back into its slot before the motor has had a chance of moving the drum.

The position of these slots is determined by the length of time taken by the chime and strike. In this case three quarters of one revolution is taken up by the chime and strike for the hours, and one quarter of a revolution for the half-hour.

For the benefit of those who have not seen the principle of H. Stocker Harris's chime, perhaps I may briefly explain that a drum is covered with sheet celluloid or acetate film. Holes are punched through this film permitting contact arms to make contact on to the brass drum. The drum revolves once an hour, i.e. three-quarters at the hour and a quarter at the half-hour. Holes for the hour strokes are arranged in vertical columns, i.e. one to twelve. A cam suitably geared lowers a contact arm on to the

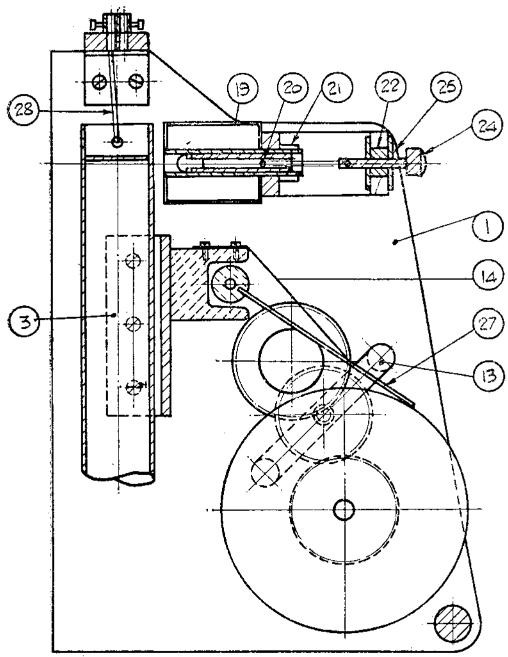


Fig. 2. *Section on A B, viewed in the direction of arrow X, Fig.* 1

drum corresponding to the hour, which thus makes contact with the correct line of holes for that hour.

The drum is shown at *11* (Figs. 1 and 2) and the roller or cam with twelve flats on it arranged in a spiral at *12*. This should be insulated from the base if made of metal, otherwise, as can be seen in Fig. 2, the contact arms will be short circuited to earth. Perhaps it would be as well to make this roller of bakelite, although in my case I made it of thick brass tube and inserted bakelite ends into it, fixing it to the spindle with a grub-screw in a boss on one of the bushes. At the right of the drum is a twelve-to-one gear train, which, driving the roller brings each successive flat round into position each hour. A bearing for the intermediate gears in this train is carried on two short pillars with a brass plate across them, *13*.

The contact fingers are short lengths of silver-steel with a small ball-bearing soldered on the end for contact. Each finger is threaded 10-B.A. and screwed into a bakelite disc with a hole through the centre, taking care that the finger does not go through into this hole and short circuit the contact to the spindle when inserted. A piece of bakelite was milled out with twenty cavities into which these discs would fit nicely (Figs. 2 and 3). A long hole was drilled the whole length of the block and a spindle pushed through from end to end, inserting a disc with contact finger in each cavity. A piece of thin spring brass is bent and fixed to the bakelite over each finger acting as a light leaf spring *14* to ensure good contact. The screws holding these leaf springs down also form terminals for connecting the wires to its corresponding bell or chime. In Fig. 1 only one finger and one spring are shown so as not to confuse the drawing, but, of course, there will be one spring and one contact on each of the twenty centre-lines shown.

The small 230-volt synchronous motor used for driving the unit was obtained second-hand and had evidentally been a clock or meter driving motor. It did not require much gearing down to bring it to about the correct speed for rotating the drum.

A clutch is inserted in the drive. This consists of a gear *15* mounted on a short piece of tube with a brass disc *16* fixed on the other end. This piece rotates freely on the main shaft, the spur wheel meshing with the output spur of the motor. Two or three coils of a coil spring *18* on the main shaft keep the brass disc against a fibre disc carried on another brass clutch plate *17* fixed to the main shaft. Just sufficient pressure is allowed on this clutch to drive the mechanism. Thus, when the release arm drops into the stop-wheel the clutch can slip until the motor comes to a standstill.

The chimes consist of 16-gauge brass tube. Eight are used for the chime and one for the strike. Only one tube is shown at *F*, Fig. 1, on the section line *AB* for the sake of clearness. The tubes were

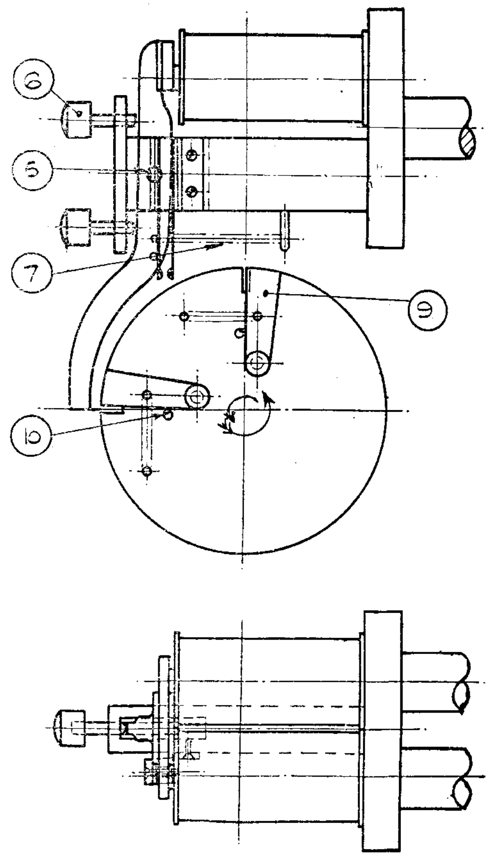


Fig. 3. (*above*). *Side view of relay and start wheel* (*half scale*). (*Below*). *Plan view of relay*

cut to give an octave and were finally tuned with the aid of a piano. In order to get them in my clock case they could not be very long, and so are inclined to be rather in a high key but quite pleasant. The approximate lengths are $10\frac{1}{2}$ in.-11 in.-$11\frac{9}{16}$ in.-$12\frac{1}{4}$ in.-$12\frac{15}{16}$ in.-$13\frac{5}{8}$ in.-$14\frac{5}{16}$ in.-$15\frac{1}{16}$ in.

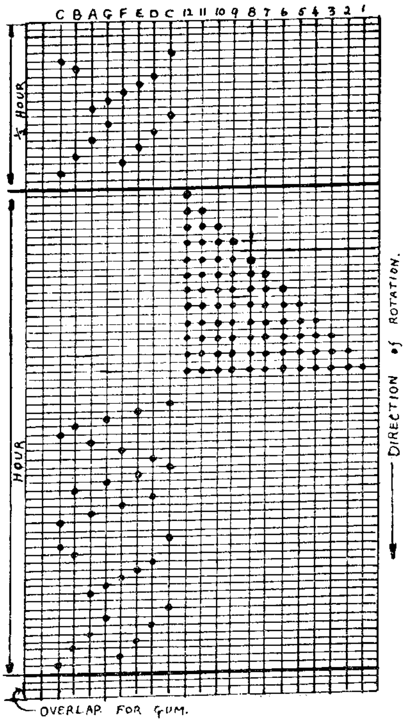


Fig. 4.

The Whittington chime for eight bells was used, which has 16 notes for the half-hour and 32 for the hour.

A tone bar was fitted at the top of each tube as explained by Mr. Stocker Harris and they are suspended on pieces of round gut *28* which pass through a hole in the top of each tube, the ends being held by passing them into holes drilled in the top stretcher bar and clamped by small 6-B.A. screws. In the photograph of the complete chime a very short tube can be seen on the right for the hour strike. This short length was put on only for testing purposes whilst on the temporary stand. This stand consisting of two bent iron straps is useful for test purposes but is not part of the unit. Two short pieces of angle brass, one attached to each side plate form a support to fix the unit to two angle-brackets in the clock cabinet.

Fig. 4 shows how the music (Fig. 5), is laid out on the celluloid sheet for covering the drum. The length being equal to the circumference of the drum plus a ¼ in. for overlap and sticking. The width is divided out the same spacing as the contact finger block. The vertical lines are now numbered for the strikes 1 to 12 and then the eight notes. The length is then divided off to give the spacing required for the tune. It will be noticed I have allowed double spacing between the strikes and four spaces for the pause between end of chime and beginning of striking.

The solenoids which operate the tubes (Figs. 1 and 2) consist of pieces of ¼ in. bore brass tube. One end is treated with a fine thread for about ⅜ in. Two iron discs are soldered on this tube, one at the end which is not threaded and the other $1\frac{1}{4}$ in. down to form a bobbin. Nine of these bobbins are required and after the usual covering of paper and shellac are wound full of 30-gauge silk-covered wire. Two small holes in the front disc enable one to bring the ends of the wire to the outside. A piece of thin-gauge steel or iron tube *19* is then slid over the coil and is a tight fit on the iron discs, thus forming a closed magnetic circuit.

The plungers or strikers are pieces of iron rod turned to a nice easy sliding fit in the brass tubes. These strikers are drilled out about half their length to take a small pull-spring which is held to the bottom of the hole by drilling a hole at right-angles across the bore and inserting a small flush pin, *20*. A piece of fibre turned to fit a short hole drilled in the other end of the striker forms the head for hitting the chimes.

The solenoids are fixed to the unit by inserting the protruding threaded ends of the bobbins into holes drilled into a brass bar *23* fixed between the

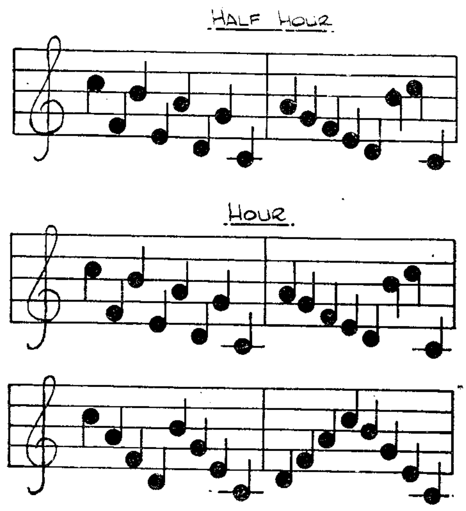


Fig. 5. *Whittington chimes—8-bell*

two end plates. A fine threaded nut *21* holds them rigid on to this bar. Another bar *22* running parallel with the solenoid carrying bar is also fixed between the two plates and has nine 4-B.A. clearing holes drilled through it at the same centres as the solenoids and carries nine 4-B.A. adjusting screws, *24*. These screws are drilled at the ends and take the ends of the springs protruding from the strikers and with a lock-nut back and

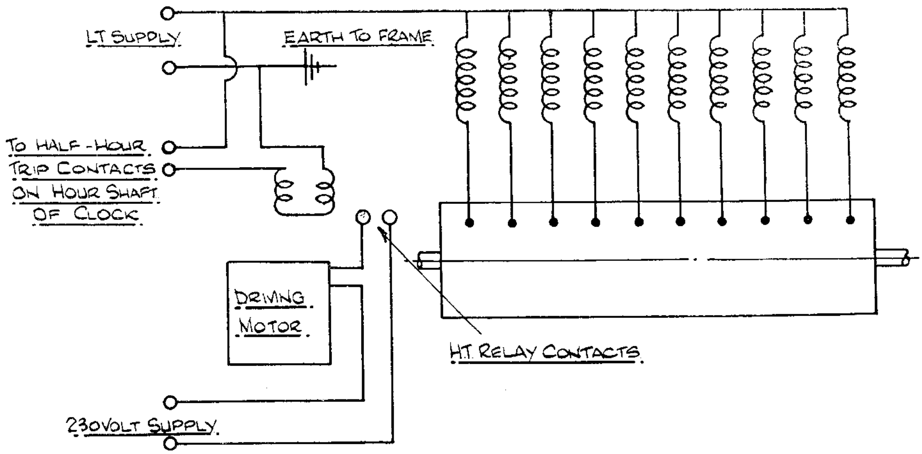


Fig. 6. Wiring diagram

front *25* form a means for adjusting the strikers to give the best position in the bobbin for striking the chime.

The square block *26* (Fig. 1) attached to the bottom bar is a small bakelite box containing terminals and a fuse for coupling the 230-volt circuit to the driving motor. The speed of the motor, or rather the speed of the main shaft and drum, can, of course, vary to suit one's own idea of how fast or slow the tune should be played. The speed of my drum is approximately one revolution in 45 seconds.

Safeguarding Electric Wires Against Heat and Damage

by W. M. Halliday

VERY often the amateur engineer, when making a temporary electric wiring installation, or when mounting a machine in a certain position, may find it necessary to locate the wire cable carrying the current in such a position where it will be subjected to very high temperatures, or be exposed to rather severe mechanical stressing.

Exposure to such heat or rough usage will, of course, very speedily break down the normal cotton or rubber insulating sheath encasing the wires, which condition would prove extremely dangerous.

A useful and very successful method which was recently adopted by the writer with excellent results in just such an instance is as follows.

A small machine had to be located in a new position, and the electric cable was to be carried down a galvanised metal partition. At the opposite side of this partition was a heating stove. It was desired to protect the cable against the rather high temperature transmitted to the partition. This was done in the following manner.

The wire was first tightly wrapped with ordinary asbestos tape, taking care to wind this spirally backwards and forwards so that a good overlap was obtained on each layer, thereby totally enclosing the whole wire.

The winding was then given a thick coating of sodium-silicate. This material was applied with a stiff brush taking care to cover amply all the asbestos tape.

When set, a second much thinner coating was applied in the same manner.

The sodium-silicate in its wet state has some corrosive properties, therefore the user should take care to wear gloves when applying the material.

These coatings will very speedily dry hard, and it will then be found that the wire has a tough, durable, yet quite resilient cover capable of effectively resisting great heat, and also most forms of mechanical damage likely to be encountered.

For example, the coating will not crack or peel off even though the wire is bent excessively, or at acute angles. The coating is also quite strong enough to resist considerable rubbing or abrading action.

It will retain its flexibility for a very considerable period. As a sealing agent against moisture, fume, or grit-laden atmospheres it will also prove most efficacious.

After being treated in this manner the wire can be put into use within one hour of the application of the coatings.

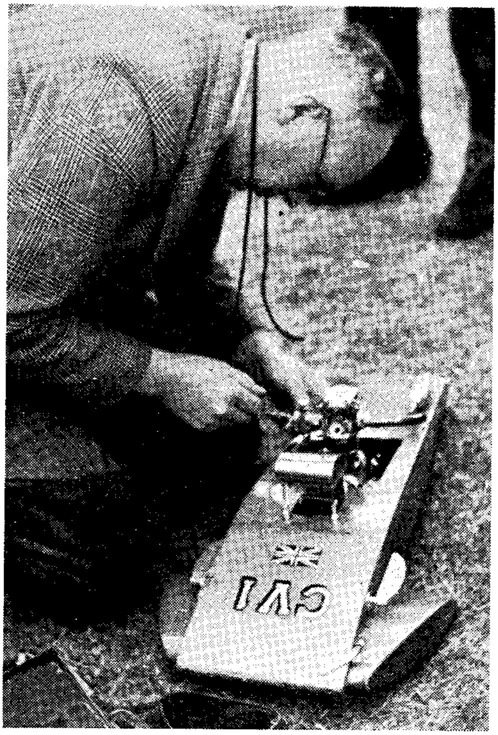
The author has employed this simple, inexpensive method with very good results, and on the particular installation mentioned, no signs of deterioration were observed over a space of five months, notwithstanding the fact that the flex was loosely attached to the partition.

THE BOURNVILLE REGATTA

THE Bournville Model Yacht and Power Boat Club's annual power boat regatta is always well supported, especially by Northern and Midland clubs.

This year's regatta received even better support than usual, including a coach-party of competitors and friends from some of the London clubs, which all helped to swell the attendance.

After an official opening of the regatta by Lt.-Col. G. E. E. Ross, Sen. Manager of the City of Birmingham Parks Department, the Class "C" and "C" restricted boats made an appearance. Both types were run on the same line and in no special order, but there were separate prizes for each class. The distance was to be 500 yd. with the usual half lap start.



Mr. Churcher (Coventry) making adjustments to his "B" class boat Annette II

There were about a dozen entries altogether, including four from Derby, who are very strong in 10 c.c. boats. The running of most of the boats was well below form—cutting-out and capsizes were frequent and only a few competitors could record a time for both runs. The highlight of this event was the appearance of a new boat built by R. Mitchell (Runcorn). The engine of this boat is unique—a split-single two-stroke engine driving twin surface props! Although this boat has made but a few trial runs, its performance was good enough to win the Class "C" prize at a speed of 37.75 m.p.h. Another new boat in Class "C" was *Dagwood* built by L. Barnes (Derby) and G. Pym (Derby) is now running *Silver Lady* in succession to *White Lady*.

D. Jones (Altrincham) with *Jo-Mac* was unlucky when the accumulator jumped out when on its third lap, this accident caused much groping on the lake bottom trying to locate it. After a short search, salvage operations were successful, much to the satisfaction of all. The winner of the "C" restricted prize was the youngest competitor, C. Stanworth (Bournville) with *Meteor II*, speed 33.44 m.p.h. In fairness to these small craft it should be noted that the wind caused the water to be a bit disturbed.

The next event was the 500 yd. "B" class race for the handsome D. W. Collier Trophy, and this race was thrilling to watch.

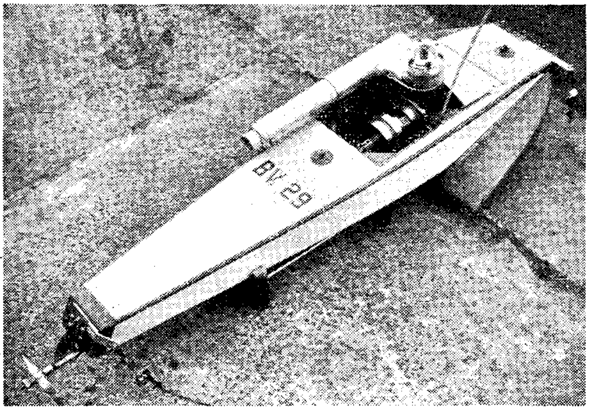
First boat on the line was *Undine,* owned by F. Talbot (Runcorn) and it made a good run at 35 m.p.h. The next boat to record a high speed was the "B" class record holder, *Sparky,* owned by G. Lines; 53.28 m.p.h. was the average for the distance which is the best regatta performance to date by this boat; this was in spite of a water surface that was not ideal for really high speeds. R. Mitchell (Runcorn) who has held the Collier Trophy for two years running, made a beautifully clean run with *Beta II*, but at a lower speed than *Sparky*. These two boats were the fastest in the race, but neither of them completed the course on the second attempts, so the first runs were the deciding factor.

Of the other boats, N. Hodges (Orpington) with *Sparta* did 30.63 m.p.h., but could not better this on a second try. E. Collins (Victoria), was in trouble with stalling upon the getaways, while F. Talbot's *Undine* on a second run went round in a series of gigantic bounds before the engine cut out. In all, seven boats contested this race.

The last of the speed events was the "A" class race for the "Coronation Speed Trophy" and K. G. Williams (Bournville) had a fairly easy task in retaining this fine trophy. Out of four competitors the only serious rival was W. Meageen (Altrincham) with *Samuel*, K. G. Williams's best speed with *Faro* was 46.18 m.p.h. while *Samuel* did 38.2 on one run, but failed to start the run on other attempts.

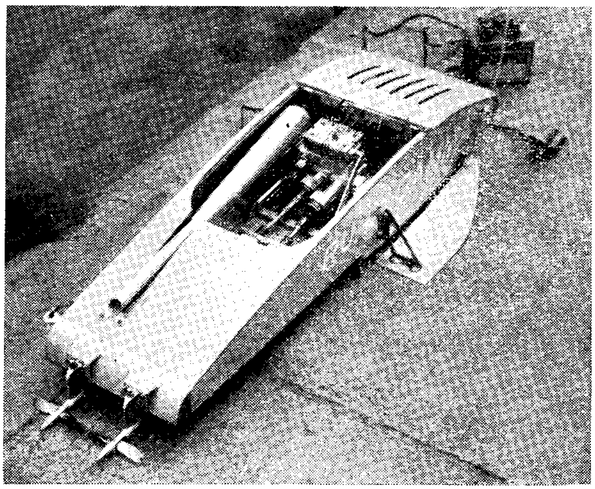
The steering contest for the "A. Hackett Steering Trophy," brought forth the largest entry ever. Twenty craft took part, but a long course (about 65 yd.) eliminated quite a few boats. Mr. Hood (Swindon) could do no better with *Truant* than one inner and one outer, which gives some idea of the task, since *Truant* is well known for straight running.

A boat new to regattas F. Robinson's *Honey*



The youngest competitor, Mr. C. Stanworth (Bournville) took first place in Class " C " (R.) with " Meteor IV "

Bee (Coventry) made a fine debut, scoring two bulls and a " blob," this craft is a petrol cabin cruiser with plenty of detail work, and looks and runs well. The home club boats fared badly in the scoring, the best of these being M. Picknell's steam launch, with 4 points. One of the last boats to run was the evergreen *Leda III* and E. W. Vanner showed 'em how to do it with an inner and two " blobs " ! This performance won the event and the A. Hackett Trophy, which is held for one year. The clubs taking part in the regatta were : Bournville, Blackheath, Coventry, Runcorn, Altrincham, Victoria, Orpington, Kingswear, Croydon, Swindon, Birmingham and Derby.



Mr. Mitchell's new " B " class boat " Gamma," which has several daring and original features

Results

500 *yd. Class " C " Race* :

1. R. Mitchell (Runcorn), *Gamma* : 27.2 sec., 37.75 m.p.h.
2. L. Barnes (Derby), *Dagwood* : 32 sec., 31.98 m.p.h.

500 *yd. Class " C " Restricted Race* :

1. C. Stanworth (Bournville), *Meteor II* : 30.6 sec., 33.44 m.p.h.

500 *yd. Class " B " Race* For D. W. Collier Trophy " ;

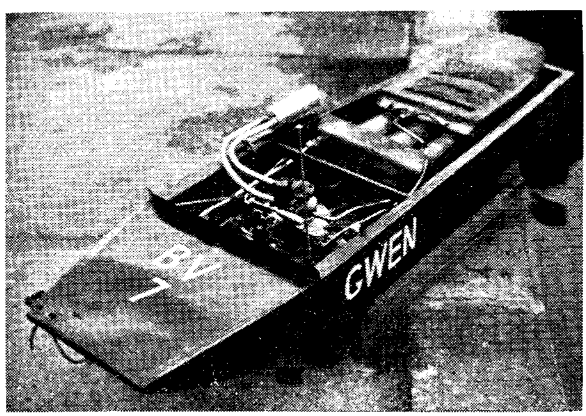
1. G. Lines (Orpington), *Sparky II* : 19.2 sec., 53.28 m.p.h.
2. R. Mitchell (Runcorn), *Beta II* ; 23.3 sec., 43.9 m.p.h.
3. F. Talbot (Runcorn), *Undine* : 28.8 sec., 35.52 m.p.h.

500 *yd. Class " A " Race.* For " Coronation Trophy " :

1. K. G. Williams (Bournville), *Faro* : 22.15 sec., 46.18 m.p.h.

Steering Contest. For " A. Hackett Trophy " :

1. E. W. Vanner (Victoria), *Leda III*: 13 pts.
2. F. Robinson (Coventry), *Honey Bee* : 10 pts.
3. J. Benson (Blackheath), *Comet* : 7 pts.



The only flash steam racing boat. Mr. G. Williams's " Gwen " (Bournville club)

Race-car Notes and Tips from the U.S.A.

by Howard W. Frank

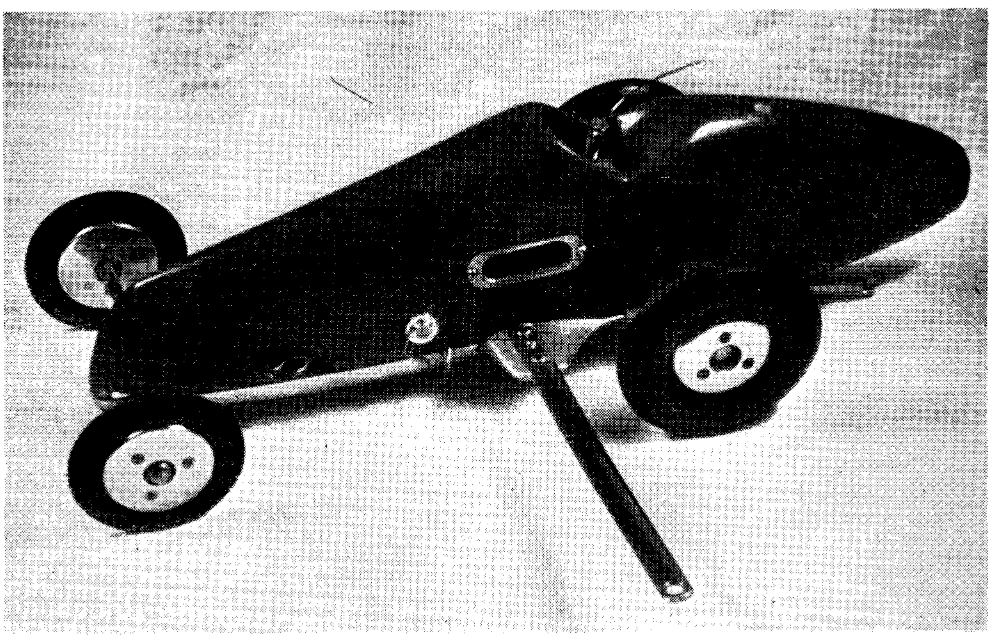
SINCE my last report was written there has been little news concerning model race-car equipment, and since the racing season is just now getting into full swing, race meet results have not as yet shown any remarkable changes since the winter meet in Florida. In the 5 c.c. class we have the official report of a Dooling "29"-powered car doing 98.90 m.p.h. at a midwestern race.

To show the development of one particular model car, namely my own Dooling "Arrow" (same as W. S. Warne car) and Dooling engine, I would like to detail a few of the modifications made during a period of two years. All speeds shown were made on the track of the Long Island Auto Racing Society.

Regarding the last shown speed of 135.95 m.p.h., this run was made under good weather conditions when the temperature was 70 deg. and humidity 30 per cent., barometric pressure 29.95. The missing 25 per cent. in the above fuel mixtures was either castor oil, or 22 per cent. castor and 3 per cent. additive diesel lubricant.

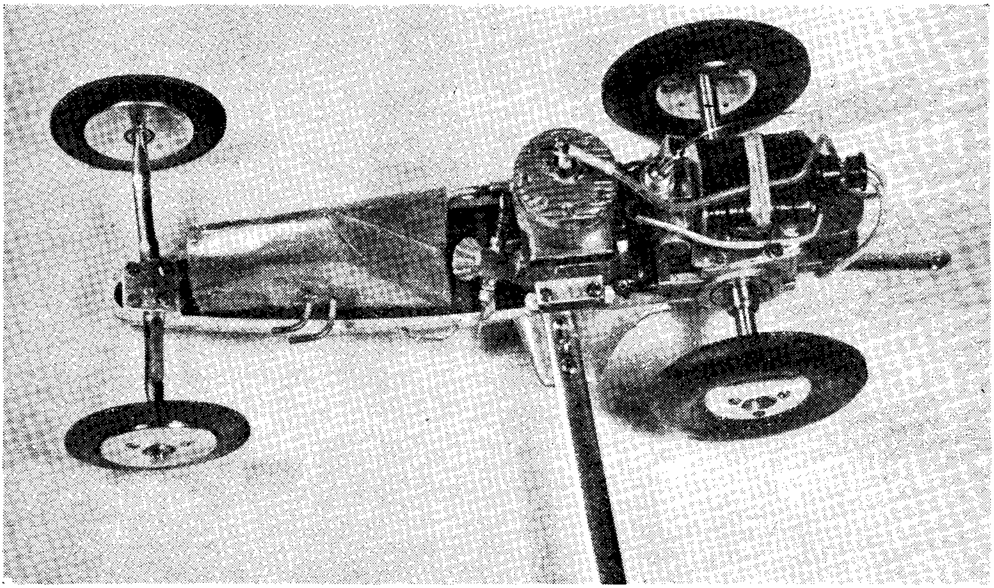
The faster cars in America are balanced carefully, so that when fully loaded with fuel and battery, there shall be no toe-in, and when the car is hung by the bridle, both axles will be perpendicular to the ground. Since the vertex of our bridles is only 9 in. from the centre-line of the car, it is comparatively easy to balance the car so that all four wheels will ride on the track and maximum traction is gained. Since all

Speed	*Fuel*	*Modifications*
110.29 m.p.h. ..	75% Meth. 25% Castor ..	Stock Car (1.5 gears)—Stock engine
117.95 ,, ..	50% Meth. 25% Nitromethane	,, ,, ,, ,, ,, ,,
121.95 ,, ..	50% Meth. 25% Nitro. ..	1.84 gears installed, engine fitted with chrome liner, H.C. head, polished. Tyres changed $\frac{1}{4}$ in. tread, 4 in. expansion.
124.82 ,, ..	50% Meth. 25% Nitro. ..	High and oval tank installed.
127.84 ,,	40% Meth. 35% Nitro. ..	$4\frac{1}{8}$ in. drive tyres installed.
130.43 ,, ..	25% Meth. 50% Nitro. ..	Spark advanced from 0.190 to 0.205.
135.95 ,, ..	30% Meth. 45% Nitro. ..	Complete car rebuilt with balsa top, pan lightened, drop front axle and "frying pan handle" installed.



Howard W. Frank's modified Dooling "Arrow" with balsa body, and frontal area reduced to a minimum. Cooling duct to cylinder-head only. Weight of complete car with fuel—5 lb. Note "frying pan handle" bridle

of our top prototype cars have rear wheel drive, we try to place as much of the weight distribution over the rear axle, and thus eliminate slippage. We have also learnt that using hard drive tyres (very little expansion) will allow our Dooling and McCoy engines to really "wind out," methane to mix with your castor oil and methanol, use from 5-10 per cent. nitrobenzene to help blend the mixture (this will also increase performance slightly). Do not use a high percentage of nitromethane for speed runs which will be officially timed for more than a quarter



Modified Dooling "Arrow" with shortened pan, drop front axle, oval tank, weight distributed over drive axle; plunger-type fuel shutoff valve connected to ignition switch; 1.84 gear ratio; engine fitted with chrome liner, high compression-head, ports and rotor polished. Identical car to A.M.R.C.A. record-holder, at 142.63 m.p.h. for quarter mile, owned by Wayne Doerstler of Lancaster, Pa.

somewhere in the neighbourhood of 20,000 r.p.m.

Fuel Discussion

The use of nitromethane in the fuel mixture has been found to give the greatest increase in speed. I have known of some western cars that will burn as much as 65 per cent.; but frankly, I feel 35 per cent. is a good compromise considering safety to the motor and high speed. A fuel mixture containing only 30 per cent. nitromethane will give an increase of over 1,000 r.p.m., or approximately 7-8 m.p.h., depending on the gear ratio, as against a straight methanol fuel.

When you use nitromethane, do so only in speed events, and do not run the car lean at the start of the run. I have found that it is necessary to open the needle valve 1½-2 turns more with a 30 per cent. nitromethane fuel than with straight fuel. My car is adjusted so that it will hit its peak speed between the 15th and 20th lap on a 1/24th mile track.

Do not use less than 25 per cent. castor oil at any time, and do not start right out trying to use 30-50 per cent. nitromethane. Start with 10 per cent. and work higher from there. A *fuel shutoff valve is a necessity.* If you have trouble getting higher percentages of nitromile distance. and when the car reaches its peak speed, listen for any loud "crackle" which is a warning that your engine is getting too hot and the oil is oxidising; the piston will burn up within four laps if you fail to shut down the engine.

As for climatic conditions when using nitromethane, we have found no trouble using as much as 50 per cent. when the temperature is between 55 and 80 deg., humidity between 35 and 60 per cent., with the barometric pressure 29.90 to 30.10 in. Use common sense as to the amount of nitro chemicals in your fuel if conditions are far from ideal, and may I repeat do not vary the amount of castor oil; you cannot use nitromethane as an additive to a straight three-to-one methanol-castor fuel, it must be part of the 75 per cent. "fuel" compound.

I would like to give you an example of what has been done with fuels over here. A group of eastern sports car enthusiasts are now preparing for road racing over short courses and in their British MG they are burning a fuel of 82 per cent. methanol and 18 per cent. nitromethane. With this fuel the MG engine is peaking at 7,800 r.p.m., but runs very rough below 4,000 r.p.m. I might add that when the car pulls into the pits, the engine will not shut off until the mechanic cups his hands over the venturi.

Novices' Corner
Using the Parting Tool

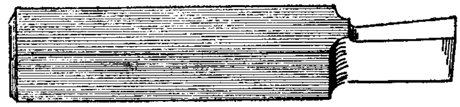


Fig. 1. *A forged form of parting tool*

MANY workers seem rather afraid to use the parting tool, as the result perhaps of an unfortunate experience connected with the tool digging in and causing damage either to the work or to the tool itself. However, when the parting tool is properly used it will be found a valuable means of cutting off machined parts to length, and also for cutting up round bars ; in fact, when it is employed for this purpose, instead of the hand hacksaw, much labour will be saved where the lathe is power-driven, and, moreover, the cut will automatically be made straight across the work, thus saving material as well as the necessity for much subsequent machining to true the ends of the work.

The causes of failure in parting-off are usually obvious to experienced workers, and those who have difficulty perhaps do not realise what are the proper conditions for successful working, nor do they appreciate that the strain thrown on all the parts concerned may often be severe.

In the first place, the lathe mandrel and its bearings must be in good order and correctly adjusted to remove unwanted shake, for when the mandrel is a loose fit in its bearings there may be nothing to prevent its rising under the pressure of the cut, with the result that the work rides up on the tool and a dig-in or jam then takes place.

Even if the lathe bearings are in good condition, the lathe itself must be sufficiently rigid to withstand the stresses imposed, and it is unreasonable to expect a small light lathe to deal with heavy parting-off operations. Nevertheless, much can be done, by using a suitable tool and modifying the working conditions, to enable a well-made small lathe to do all ordinary parting-off work.

The Parting Tool

The lathe worker soon discovers that, when a tool with a broad cutting edge is fed into the work, chatter is apt to arise, and that this can be largely overcome by reducing the width of the tool in contact with the work. This applies especially to a tool shaped like a parting tool which is normally fed directly inwards and not traversed along the work. It is essential therefore, to keep the cutting edge of a parting tool as narrow as possible. As the width of the edge is reduced, so the strain both on the work and on the tool is lessened ; but the tool itself must be made strong enough for its purpose by providing a sufficient depth of metal to support the cutting edge. For use in light lathes, the cutting edge is usually made of from $\frac{1}{16}$ in. to 3/32 in. in width, but some workers get good results by using a tool made from a piece of hacksaw blade which has a thickness of only 0.024 in.

When the parting tool is forged from a length of square-section tool steel, it has the appearance shown in Fig. 1 which represents the usual form of tool obtainable from the tool merchant.

To reduce a piece of square bar to this shape, without preliminary forging, will call for much work on the grinding wheel, but less grinding will, of course, be required if square tool-bits of, say, $\frac{1}{4}$ in. section are used for this purpose. The Eclipse brand of tool steel is, however, supplied in short lengths already ground to the correct form for use as a parting tool. Two patterns of this material are obtainable : the first, Fig. 2A, has its sides ground flat, and the other, Fig. 2B, is hollow-ground in order to enhance its free-cutting properties. As the hollow-ground variety in the smallest size has a width of only $\frac{1}{16}$ in. and a depth of $\frac{1}{2}$ in., it will be found suitable for use in small lathes when mounted in a tool holder. This form of material is of uniform cross-section throughout its length, and, when resharpening becomes necessary, only the front edge of the tool is ground to restore the cutting edge. Short lengths of ground, square-section steel in the form of tool-bits are also supplied by the leading steel makers, and, when this material is used to make a parting tool, the cutting tip is ground to the shape shown in Fig. 3.

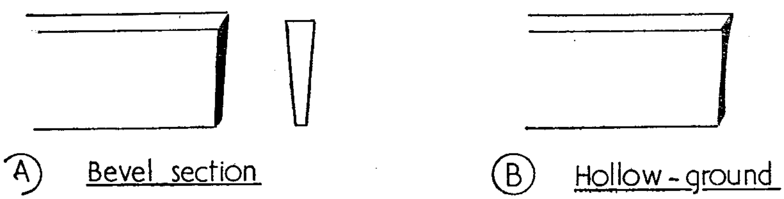


Fig. 2. *The two types of "Eclipse" parting tool*

Where the width of the cutting edge is only some $\frac{1}{16}$ in., the clearance angles formed on either side of the tip should not exceed 3 deg., otherwise the point of the tool will be unnecessarily weakened. For the same reason, the relief angles, which make for free-cutting, must also be kept small ; in fact, the sides of the tool tip when viewed from above should appear almost parallel. Although, to prevent digging-in, top rake should not be given to a tool used for parting-off

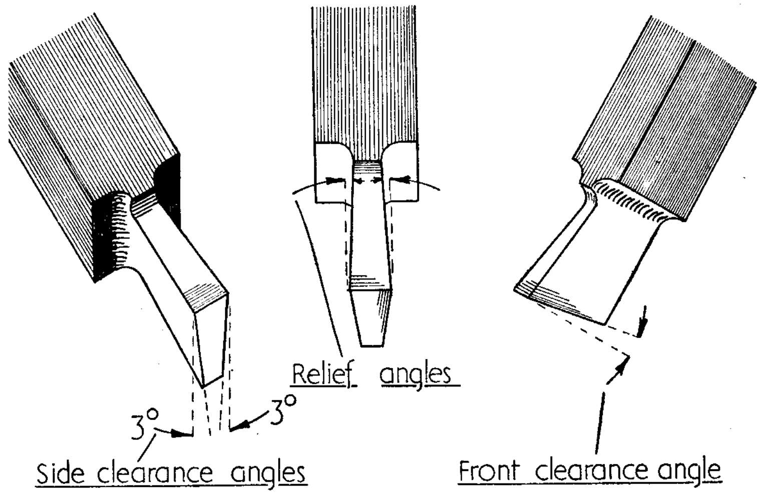


Fig. 3. Showing the formation of the parting tool's tip

brass, this rake will, however, greatly improve the tool's free-cutting qualities when machining steel.

The manner of grinding this top rake is important, for should it take the form of a curve of small radius, as illustrated in Fig. 4A, the chip will tend to curl into a tight coil and jam in the groove cut in the work; whereas a top rake shaped with a flat lead-off, as shown in Fig. 4B, will keep the chip clear of the work until it becomes coiled on meeting the curve formed at the back end of the rake surface.

To maintain the strength of the tool point, the front clearance angle should, as shown in Fig. 3, be kept small and need not be greater than 5 deg. Needless to say, with so little metal to spare at the tip of a small parting tool, the clearance and rake angles must be ground with extreme care. This work will be greatly facilitated by using a grinding rest that can be set to the exact angle required, and disappointment may result if off-hand grinding is employed and the tool angles are judged only by eye. For the most part, the parting tool will be resharpened by honing the front face, and, here again, some form of honing jig will ensure that the front cutting edge is shaped to the correct angle and lies squarely across the tool.

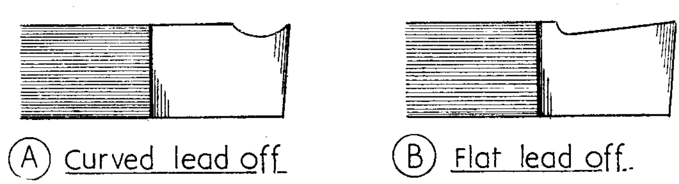


Fig. 4. Showing how top rake is formed on the tool

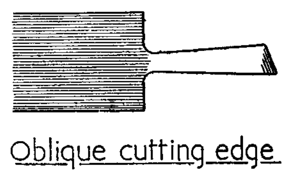


Fig. 5. A parting tool with obliquely ground cutting edge

The construction of both an angular grinding rest and a simple form of honing jig is described in a book entitled *Sharpening Small Tools* published by Percival Marshall & Co.

With the ordinary pattern parting tool, having a squarely formed front edge, a small central pip will be left on the work when it is parted-off; to avoid this so as to leave the work with a flat surface, the edge of the parting tool should be ground and honed obliquely as represented in Fig. 5; this tool will, of course, leave a pip on the material remaining in the chuck instead of on the part cut off.

Mounting the Tool

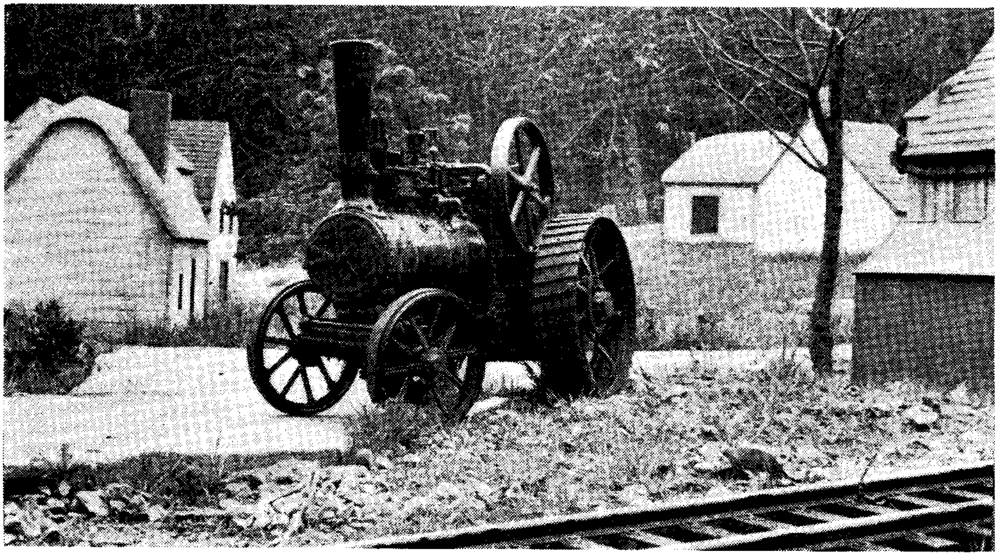
To avoid chatter and to lessen the tendency for the tool to dig into and jam in the work, it is essential that the parting tool should be rigidly mounted and set at centre height exactly at right-angles to the lathe axis; in addition, the tool should project no further than is necessary beyond the point of support in the tool holder or lathe tool post.

Experience shows that a parting tool will cut more freely and will be less liable to dig into the work if it is mounted upside-down. For this purpose a back tool post is commonly used and, as its name implies, this fitting is attached to the back of the cross-slide opposite to the ordinary front tool post. This enables the lathe to be run in the normal forward direction, and the additional tool or tools so mounted save much tool changing by increasing the number of tools immediately available.

Parting-off Operations

The importance of mounting the tool rigidly has been stated, and this also applies to the actual work-piece held in the chuck; that is to say, the part should be set to project as little as possible beyond the chuck jaws, and there should be no undue slackness in the mandrel bearings.

(*Continued on page* 17)



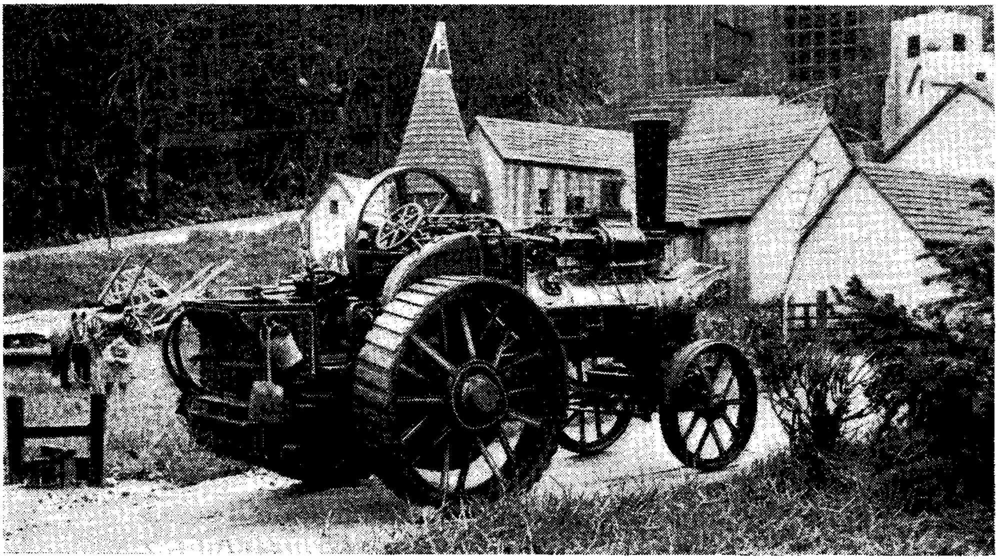
Is it really——

FROM HIND WHEELS TO VILLAGE

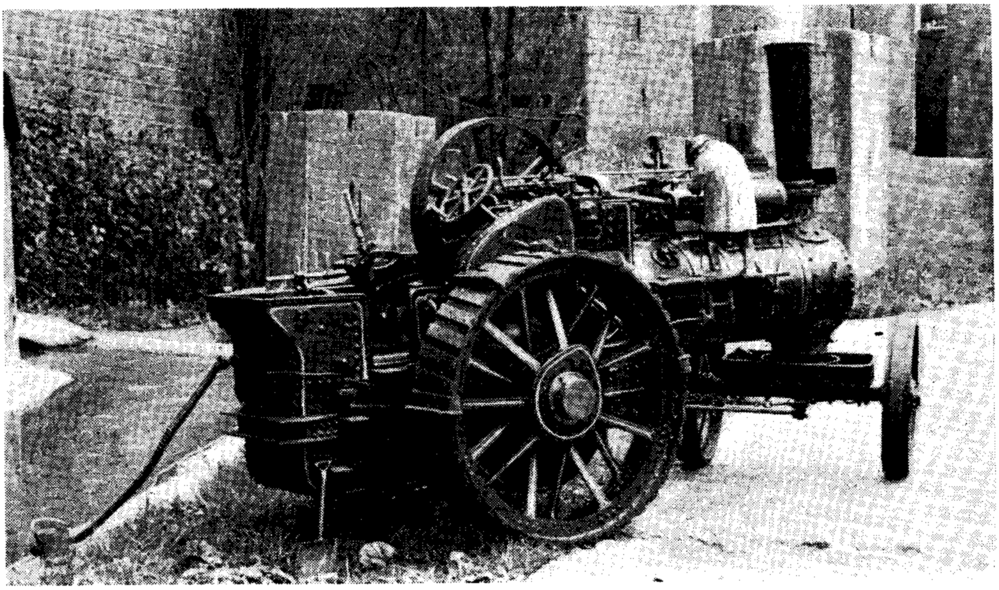
by R. Palmer

HAVING announced to my family my intention of setting down in writing the experiences which led me to build a complete model village, I was told by my daughter, whose help was enlisted, that the correct way to tell a story was to " Begin at the beginning—go right on until you reach the end—then stop ! " The said daughter's name being Avril, I feel I should apologise to Lewis Carroll !

The beginning, in this instance, coincides with my being a steam fan at the age of nine, or thereabouts. My first models were made from cotton



an 8-h.p. Marshall ?——



No! It is actually a model

A peaceful village scene

reels, cocoa tins and any other odds and ends to be had. I still recall the thrill of first using files and drills. How well those shaped pieces looked, at least to my tender eye! By the time I was eleven years of age my firm favourite was, and still is, the general-purpose traction engine. My ambition then was to possess a real drawing from which to work. With this in mind I wrote to Wallis and Stevens, and for days afterwards haunted the letter-box. No letter or drawing arrived; but, one day, I was called indoors to face a most awe-inspiring gentleman; he was, it seemed, a representative from Wallis and Stevens, and he had been sent to help Mr. Palmer with his choice of an engine! Whatever that gentleman thought of the grubby, knobbly-kneed "Mr. Palmer," presented to him, I cannot imagine, but he quickly grasped the situation, and my hand. That was the proudest moment of my young life. Good-naturedly he asked if there was any way in which he could help me. My father explained that I was having trouble with the hind wheels. After some thought, the traveller wondered if some solid wooden wheels would be of any help? He could get some turned for me, if I could use them. Could I!

Instead of the hiding I expected from my father, I was very soon the proud possessor of a set of solid wooden hind wheels. In my imagination, they were complete with driving pins, spokes, rivets, strakes and spuds; even the balls of dirt would roll along the inside of the rim, pushed through the holes that take the spud pins!

Well, the years passed, with myself always trudging after traction engines, miles from home often, just for the love of looking at them. I had various jobs, but never could get into steam.

Down by the farm

My interest never wavered, however, and I built engine after engine. My last, completed four years ago, being an 8 h.p. Marshall (see photograph). Although my children are both girls, they both found a lot of pleasure in playing with M.R. 163 in the garden. Eventually I built a small shed in the form of a barn in which to house the engine. One day I found that they had carried into the garden their two dolls' houses. "For the driver and the farmer to live in," I was told. "Why don't you build one Daddy?" came next.

One!! Once I started, I was relentlessly pursued, until now, after four years' hard labour, our garden is a village in miniature, scale 1-in. to 1-ft. In an area of 88 ft. by 28 ft. we have a church, complete with bells and Sunday services, two "locals," castle, moated-manor, windmill, water-mill and wheel, a stream bubbling over rocks and under bridges, market cross, shops, farm buildings, carts, wagons, Tudor houses and thatched cottages. I shall not cease until I see a pair of Fowler ploughing engines with

An aerial view of the village

plough and van ambling along the " village " street, towards the farm. And *I* shall also see a solitary, grubby little figure, hot on the trail, clutching a pair of solid wooden hind-wheels.

Novices' Corner

(*Continued from page* 13)

If it is found that chatter develops when the tool begins to cut, the mandrel speed must then be reduced, and it may even be necessary to engage the back gear when parting-off work of large diameter. Incidentally, a parting-off operation provides a good test of a lathe's rigidity, especially if the work is set to project for some little distance beyond the chuck jaws ; for this purpose, a rigid piece of material should be used, as it is the lathe that is being tested and not the work. Under good conditions, parting-off can be carried out rapidly and with the lathe running at moderately high speed. It is essential to maintain a constant tool feed by turning the cross-slide feed handle evenly, so that the tool cuts a chip of uniform thickness and is neither forced against the work, nor allowed merely to rub on the surface of the metal without cutting. Throughout a cutting-off operation on a steel part, a supply of cutting oil should be fed to the tool by means of a brush ; this is particularly important when a tool without top rake, as in Fig. 2, is used, for a tool of this form will usually cut much more freely when well lubricated. When parting-off bars of large diameter, the back centre may be used to steady the work in the initial stage, but as soon as the tool has entered for some distance and the work becomes less rigid, the tailstock centre must be withdrawn ; for, should the bar bend under the pressure of the cut, the tool will be nipped in the groove and a jam will result. For the same reason, no attempt should be made to part-off work mounted between the lathe centres.

Either the fixed or the travelling steady may be used to give additional support to the work at a point between the chuck jaws and the tool itself ; this may at times be found a useful arrangement when the work has to be gripped in the chuck with excessive overhang.

The parting tool may also be used for cutting grooves of any specified width and depth. The depth of the machining is, of course, determined by reference to the cross-slide index. The groove is then turned to the required width by traversing the parting tool and again feeding it in to the full depth.

To machine the groove accurately to width, the breadth of the parting tool is first measured with the micrometer and, with the aid of the leadscrew index, the saddle is traversed for a distance equal to the required groove width, less the width of the tool.

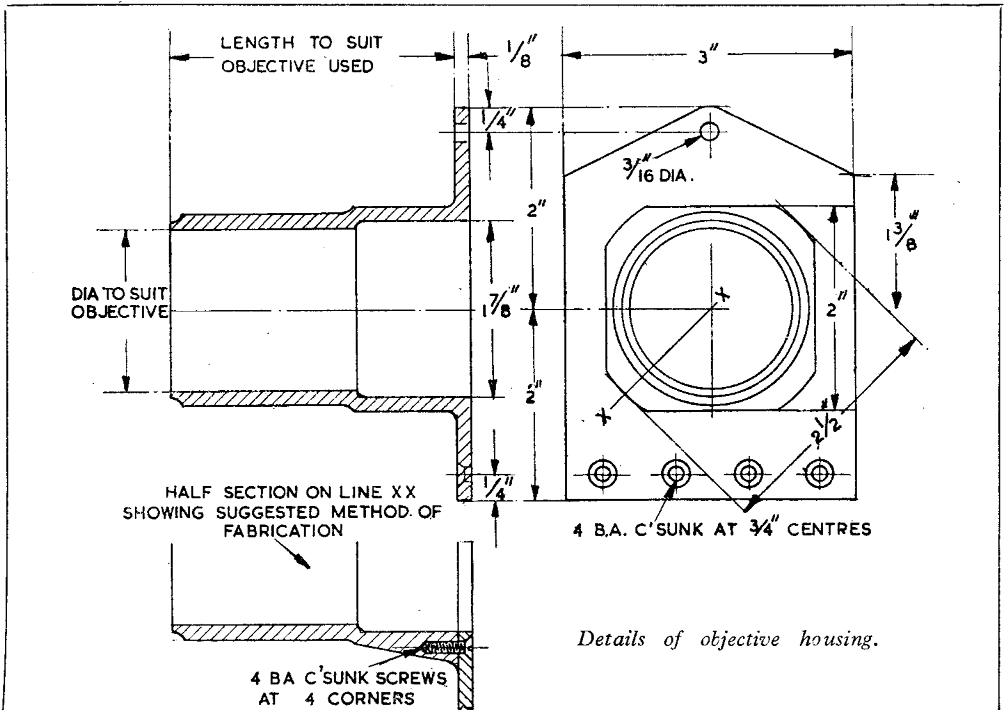
*Miniature Slide and Strip Projectors

by "Kinemette"

THE interior portions of the lamphouse should be dead-blacked on the surfaces which are exposed to light, using the matt paint as described for the other projector. It should be noted that this does not apply to the outside surface of the inner lining or the parts of the inside lamphouse surface which are screened by the lining, as these should be left bright in order to fitting a hinged rear door. No special provision has been made for this in the drawings, however, as the smaller, low-voltage lamps have been found quite adequate for all purposes to which the projector has been applied so far.

Objective Housing

It would be desirable to use a casting for this



Details of objective housing.

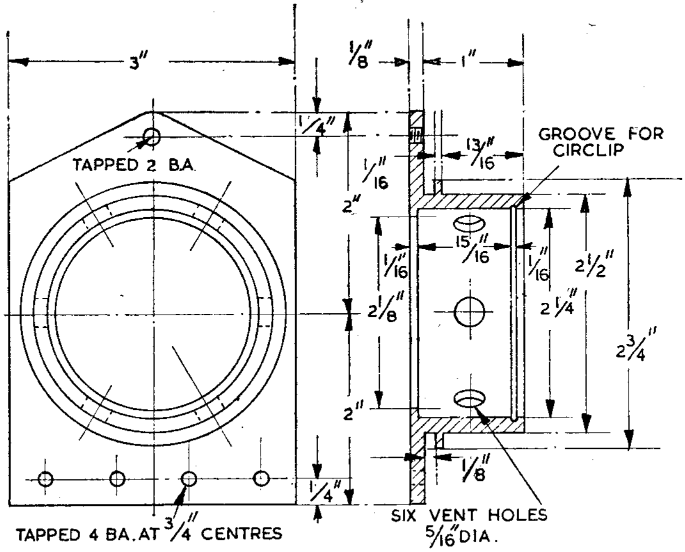
avoid either radiation or absorption of heat. The inside of the louvres, however, and surfaces adjacent to any of the ventilation apertures, should be blackened to prevent reflection of light, which would affect the efficiency of the light-trapping arrangements.

Some modification of the lamphouse design may be found desirable if it is intended to employ high-voltage lamps of the maximum wattage. The dimensions given allow of fitting a standard tubular type 250-watt lamp, but it will not be possible to insert a lamp of this size into its holder through the rear door as designed. In this case it would be preferable to make the entire lamphouse capable of being lifted off, in a similar manner to that of the smaller projector, instead of

component, though it could be fabricated from stock material in various ways. In the particular lantern illustrated, the tubular portion was turned from a hollow billet or "quill" of aluminium alloy, the rear portion being taper turned and externally squared, thereby producing sufficient thickness at the corners to enable the flange to be attached by four countersunk screws as shown in the diagonal half-section. After attaching the flange in this way, the housing was rechucked in the lathe and the aperture of the flange bored out to match that of the housing. A fillet of "cold solder" was built up around the outside of the joint, so that when finished it appeared to be made from a single piece of metal.

An alternative method of making the housing is to fabricate it from brass tube and sheet, with a silver-soldered joint. The aperture of the housing at the rear end, if left circular, must be large

*Continued from page 923, Vol. 102, "M.E.," June 22, 1950.



Condenser housing.

enough to cover the diagonal measurement of the largest transparency to be projected, or it may be squared out by annealing the tubing and driving it over a tapered square drift before brazing on the flange. After fabrication, the tube should be bored to take the objective, and the face of the flange skimmed to ensure that it is true and square.

The exact dimensions of the housing will depend on the diameter and focal length of the objective used. In this case, also, a standard sleeve-fitting 42-mm. ciné objective is specially recommended, but the focal length should in no case be less, and preferably greater than that used for the single frame projector in order to ensure adequate covering power for the larger frame area. These particular lenses are only claimed to be corrected to cover a single 35-mm. frame, however great the focal length, but long-focus lenses have natural advantages in this respect and a good quality 4-in. objective of this type has been found to cover the double frame area with a good margin in hand.

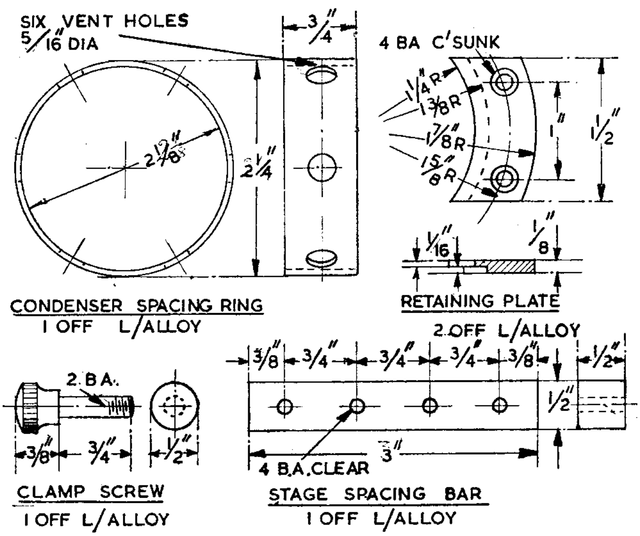
In the event of long-focus lenses being used, in order to obtain a long "throw" for projection in a large hall, it would be desirable to make the housing larger in diameter, and fit a telescopic draw tube, in order to improve compactness when the projector is boxed or packed for transport, in which case a long permanent "snout" would be an encumbrance.

No definite provision has been shown for focussing the objective, as this again will depend upon the type used, but in the experimental projector, a spiral groove of $\frac{3}{8}$ in. pitch was cut inside the bore of the housing, and the sleeve mount of the objective fitted with a small screw to engage in this groove, thus providing a very smooth-working focussing movement, with a much wider lateral range than is practicable with a spiral slot, as employed on the previous projector.

Condenser Housing

This component also may, with advantage, be made from a casting, or fabricated by brazing, but a satisfactory result has been obtained by turning a spigot on the condenser tube, to a press fit in a bored aperture in the flange, the outer side of which was slightly countersunk so that the edge of the spigot could be riveted over into it. If carefully carried out, this will provide a perfectly secure and permanent fitting; it should, of course, be done before final machining of the flange face and the bore of the housing.

A distinctive feature of this projector is that the condenser assembly, instead of being on the outside of the lamphouse, projects rearwards into it. This has been done for very definite reasons, one being that it reduces the overhanging weight of the optical system, which must all be carried on the front plate of the lamphouse, in view of the



Minor fittings for optical system.

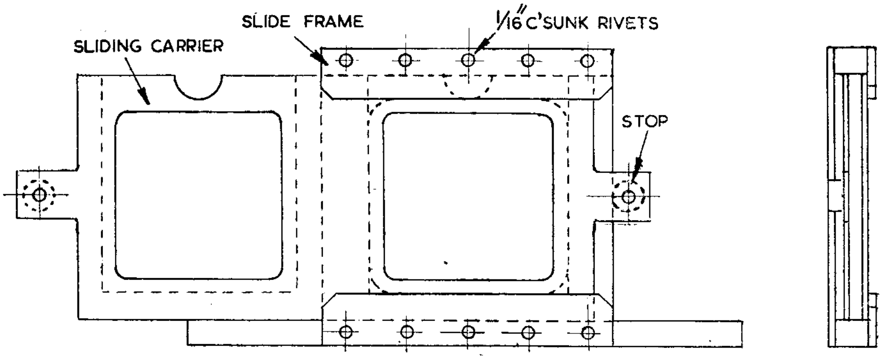
need to provide for a rotatable stage; and the other, that it facilitates ventilation and drying-out of the condenser cell. In the smaller projector, some little embarrassment has been caused by dampness in the condenser, causing clouding-up during projection, and as there is not a great deal of heat generated by the low wattage lamp, this persists longer than it does in more powerful projectors. The remedy, of course, is to switch on the lantern for a quarter of an hour or so before projection is due to start, in order to allow it to warm up properly, but there are occasions when this is not practicable, and in such cases, provision for allowing the warm air in the lamphouse to circulate through the condenser cell will ensure that it is quickly dried out.

The housing is provided with six holes of adequate size to ensure good ventilation, and the spacing ring which is inserted between the two plano-convex lenses also has similar holes which should be lined up with those in the housing when it is assembled. A positive locating device may be fitted to the ring if desired, but this complication is hardly justified unless the assembly and maintenance of the projector has to be entrusted to unskilled hands.

Some adjustment of the lateral dimensions of the ring may be necessary, as condenser lenses vary in thickness at the edges, the cheap moulded types being usually a good deal thicker than those which are optically worked. The housing dimensions shown are intended to take $2\frac{1}{4}$ in. lenses (the smallest size recommended to give proper coverage for 2 in. × 2 in. slides fitted with standard marks, or double-frame 35 mm. strips) which should be quite an easy fit in the housing, and have perceptible end play when the spacing ring is fitted. As before, a circlip is fitted in the end of the housing to retain the assembly in position.

Retaining Plates

The complete condenser housing is fitted so as to be free to rotate in the aperture of the lamphouse front, and it is retained endwise by two rebated plates, one on each side, attached to the lamphouse. These are most conveniently made by machining a ring of aluminium alloy to the radial dimensions shown, and cutting out two sections $1\frac{1}{2}$ in. wide. If desired, it would be quite in order to use the whole ring, simply splitting it in two parts to enable it to be assembled, in which case a larger number of screws should be used to secure it in position. In the detail drawing of the lamphouse, an error was made in the location of the tapped holes for the screws which secure the retaining plates, but in the normal way, these holes will be located from those in the plates, and the error thereby avoided. When the plates are fitted and the screws tightened, the condenser housing should be capable of rotating somewhat stiffly ; should it be too slack, the contact face of the plates may be rubbed down on a sheet of emery-cloth or a large smooth file, and if too tight, a paper shim behind the plate or a skim off the face of the collar of the housing, will put things right.



Complete slide carrier assembly.

If desired, stops may be fitted to the housing, to limit the turning motion to 90 deg., and locate the stage in the alternate positions for horizontal and vertical filmstrips. It has, however, been found that there is much to be said for omitting the stops, as it is often desirable to shift the stage beyond the theoretically correct position, to adjust minor errors in the angle of the picture on the screen.

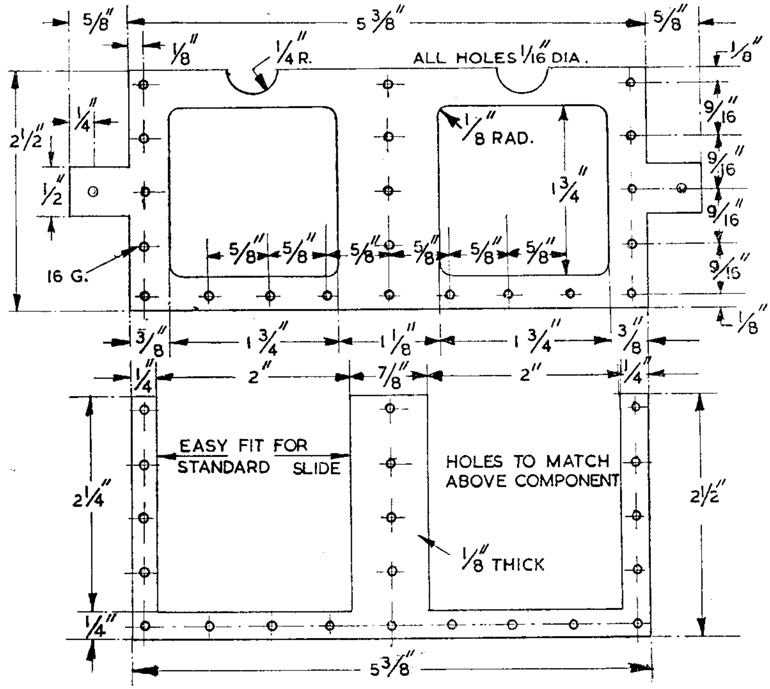
As an alternative to attaching the retaining plates by screws from the front, the holes in them may be tapped, and screws put in from the inside of the lamphouse.

The objective housing flange is attached to that of the condenser housing by four screws along the bottom edge, with a spacing bar between them, leaving a gap which forms the stage, for the insertion of the slide or filmstrip carrier. To improve the rigidity of the optical system, a knurled screw is fitted to the top of the flanges, enabling the carriers to be clamped in position, but capable of being readily removed or interchanged. This screw must not be longer than necessary to avoid the risk of fouling the retaining plates when the stage is rotated. When neither carrier is in position, it is advisable to fit a "dummy," in the form of a wood or metal block or frame, to prevent the objective housing flange being forced back and thereby bent or damaged. Alternatively, a spacing bush may be fitted on the clamp screw to serve the same purpose.

Slide Carrier

In modern miniature slide projectors, some very ingenious slide-changing devices are employed, including magazine holders and automatic or semi-automatic carriers. While these refinements add to the convenience of operating the lantern, they contribute nothing to actual projection efficiency, and operators who have had experience with " fancy " slide carriers on the larger standard size lanterns will probably agree that the less complication in the slide carrier the better. Memories of lectures or demonstrations which have been ruined by the patent carrier jamming or disintegrating at critical moments, or auto-focus devices " which ought to but didn't," will undoubtedly cause many votes to be cast for the plain two-way sliding carrier, and this is the type which is used, in an adapted form, in the present case.

The older slide carriers were usually made of wood, but most constructors will probably prefer to use metal, especially in view of the reduced size of the carrier, which would be rather fragile in the former material. In order to combine lightness with strength, light alloy such as duralumin is recommended (ordinary aluminium is too soft), though brass is also suitable, and could be reduced in thickness for most parts of the structure. Yet another practicable material is laminated bakelite board (Tufnol or Paxolin), preferably in conjunction with metal. The general arrangement given herewith shows that the carrier consists of two main parts, the stationary frame which is clamped in the stage of the projector, and the sliding holder which is provided with two slip-in frames to take the slides, and is free to slide in the frame to a limited extent so as to locate one or other of the frames central with the optical system. Both the components are fabricated from stock sheet and bar material, preferably by riveting.



Details of sliding carrier.

Stationary Frame

The stationary frame consists of four main pieces, namely the frame plate, two spacer bars and two keep plates. It will be seen that the lower spacer bar is made considerably wider than the frame to form a bearing for the sliding holder and prevent the tendency for it to sag when in either of the extreme positions. Optional, but very desirable fittings, are a pair of spring plates, made from *hard* brass 0.015 in. thick, interposed between the frame plate and the spacer bars at top and bottom, to provide a certain amount of friction and keep the sliding holder pressed against the keep plates. The slots in the spring plates should be cut with a saw rather than with shears, and this can be done quite easily by clamping them to a piece of wood and sawing obliquely ; the tongues are then bowed in the manner shown in the drawing.

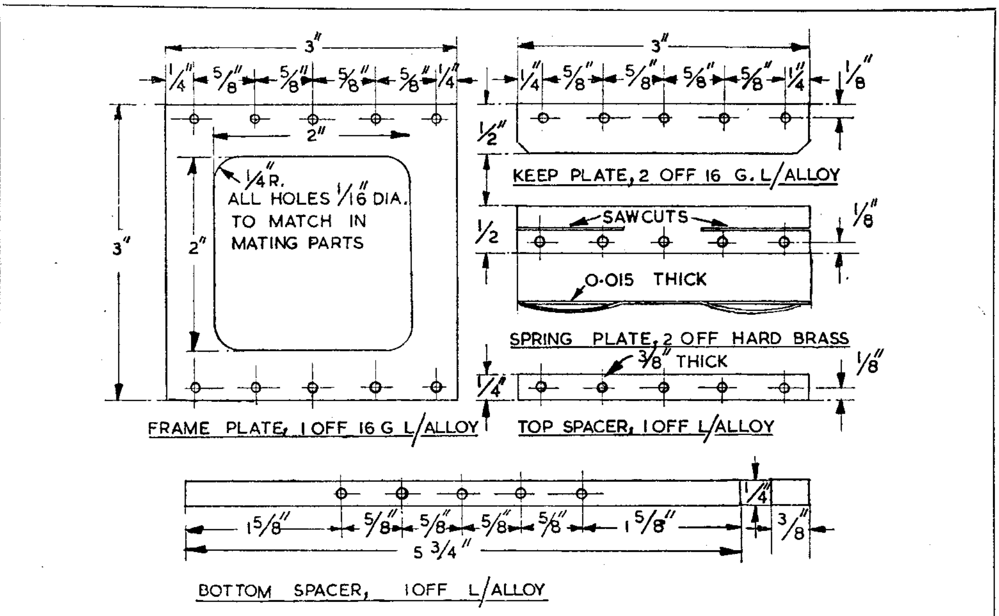
Aluminium rivets $\frac{1}{16}$ in. diameter are specified for holding the parts together, and if these are not readily available, 16-gauge aluminium wire may be used, cut into lengths just sufficient to project about 1/32 in. on each side of the complete "sandwich" assembly; this applies to both the stationary and sliding members of the carrier. The outside edge of the rivet hole is very slightly countersunk with a small centre drill (to give a more acute angle than an ordinary countersink) and if close-fitting soft rivets are used, they may be closed without hammering by clamping in the vice with *smooth* steel inserts or clamps fitted to the jaws to prevent marking the plates.

After drilling the frame plate, it may be used as a jig for the keep plates and spacer bars. Note that the thickness of the latter may be subject to modification if the sheet material used in the carrier components is of a different thickness from that specified; if the thickness of the complete frame is less than the width of the gap in the stage, it will be necessary either to reduce the thickness of the spacer bar in the latter, or to rivet pads on the face (or faces) of the frame to take up the difference, and avoid distortion of the flanges of the stage when the carrier is clamped in position. The spacer bars, in all cases, may be made of bakelite if desired.

Sliding Carrier

A similar method is employed in building up the sliding carrier, the spacer plate of which also may be made of bakelite. The gaps in this should take the standard 2-in. slide quite easily; as these vary in size to some extent, it is advisable to obtain a number of different ones for checking, allowing, of course, for the largest. This discrepancy applies also to the thickness of the slides, as the glass used may vary, and the material for the spacer should be selected accordingly. Note that if there is more than about 1/64 in. play in the holder, focussing may be altered sufficiently to affect definition, especially when a short-focus objective is used. It may in some cases be found desirable to fit a spring plate in the holder to take up play, as in the stationary frame, but the spring material should be a good deal lighter—not more than 0·010 in. thick. This has not, however, been found necessary in tests which have been made so far.

Both the components should be cleaned up after fabricating, and the rivet heads finished flush with the plates. No enamel or similar surface coating should be used on them, though oxidising or chemical finish is permissible. To stop the sliding carrier moving too far in either direction, stop bushes $\frac{1}{4}$ in. diameter are attached to the end lugs by either a rivet or a countersunk screw in each.

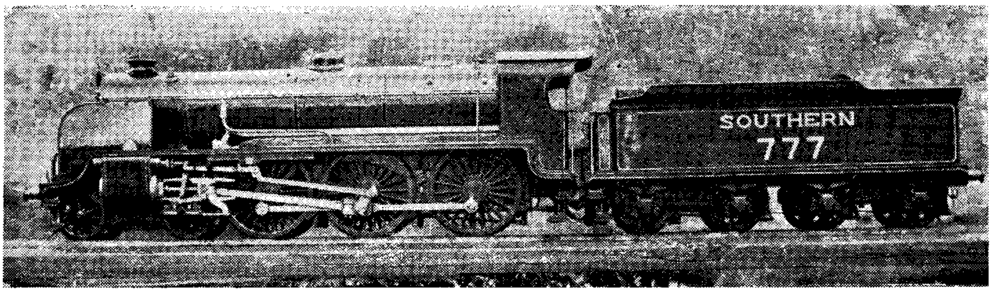


Details of stationary frame.

Slide-lifting Device

The simple sliding carrier may be improved if desired by the addition of a device for lifting the slide as it moves out of the focal plane after projection. This facilitates removal of the slide from the carrier, and the necessary modifications to the existing design are not complex or difficult to make. Details of this device will be given if it is found to be of general interest.

(*To be continued*)



Broadside view (note correct taper to boiler barrel)

A $\frac{3}{4}$-in. Scale S.R. "King Arthur"

by F. J. Streets

HAVING lived all my life in a part of the country served by the L.N.E.R., and seeing their locomotives practically every day, it was decided to build a model of a prototype belonging to some other company; therefore, I chose the S.R. "King Arthur" class.

The building of this model was begun in the late months of 1943; the only tools I used in its construction are a 3 in. centre "Pool's" lathe, bench drill 0-$\frac{1}{2}$-in. capacity, small hand drill, small drills, reamers, taps and dies, 5-pint blowlamp, and other small tools.

The frames and buffer beams were cut from $\frac{1}{8}$-in. steel-plate; all frame stretchers are castings. Driving-wheels, $4\frac{7}{8}$-in. diameter on tread, were pressed on to 9/16-in. diameter axles and are fully sprung. The bogie is equalised as in the prototype, and fully sprung, the wheels being $2\frac{5}{8}$-in. diameter.

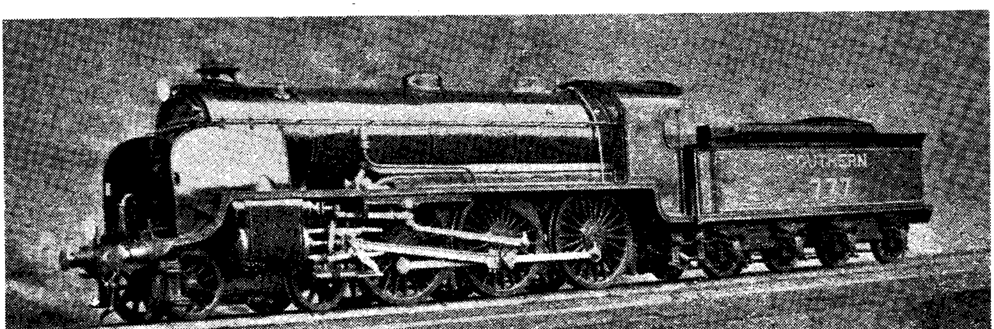
The cylinders are $1\frac{1}{4}$-in. bore $\times$ $1\frac{3}{4}$-in. stroke, but have outside-admission slide-valves; the gear is Whalschaerts, and is correctly forked as in the prototype.

The whole of the motion was cut out and filed (by hand) from $\frac{1}{4}$-in. steel-plate, with the exception of the expansion links which are 3/16-in. thick. All motion is bushed with phosphor-bronze and hardened where necessary. The fluting of eccentric- and radius-rods was accomplished (by hand) with a lathe tool. The slide-bars are 5/16-in. $\times$ 3/16-in. section, the bottom one at near side being 5/16-in. $\times$ $\frac{1}{4}$-in. and shaped to accommodate the vacuum-pump, which is not a working one, but was put on for the sake of appearance.

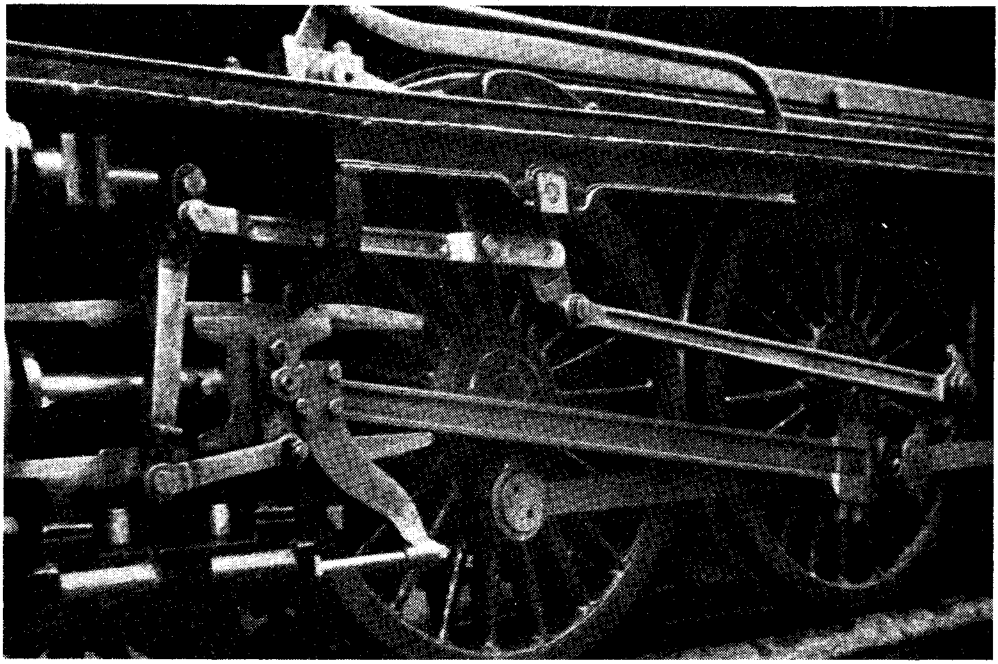
Motion-plates and link bracket girders are castings, the latter being furnished with hardened steel bushes for the link trunnions.

The engine is fitted with a steam brake cylinder which lies horizontally between the frames in line with the motion-brackets; it is fitted with a steam jacket as it is a long way from the driver's brake-valve which is in the cab. The $\frac{1}{8}$-in. pipe which carries the steam to and from the valve to cylinder is enslosed inside a $\frac{1}{4}$-in. pipe which takes the steam to the cylinder jacket, and is therefore, surrounded by steam all the time it is in operation, which eliminates condensation, and has proved a success. The brake-gear is compensated as on the prototype.

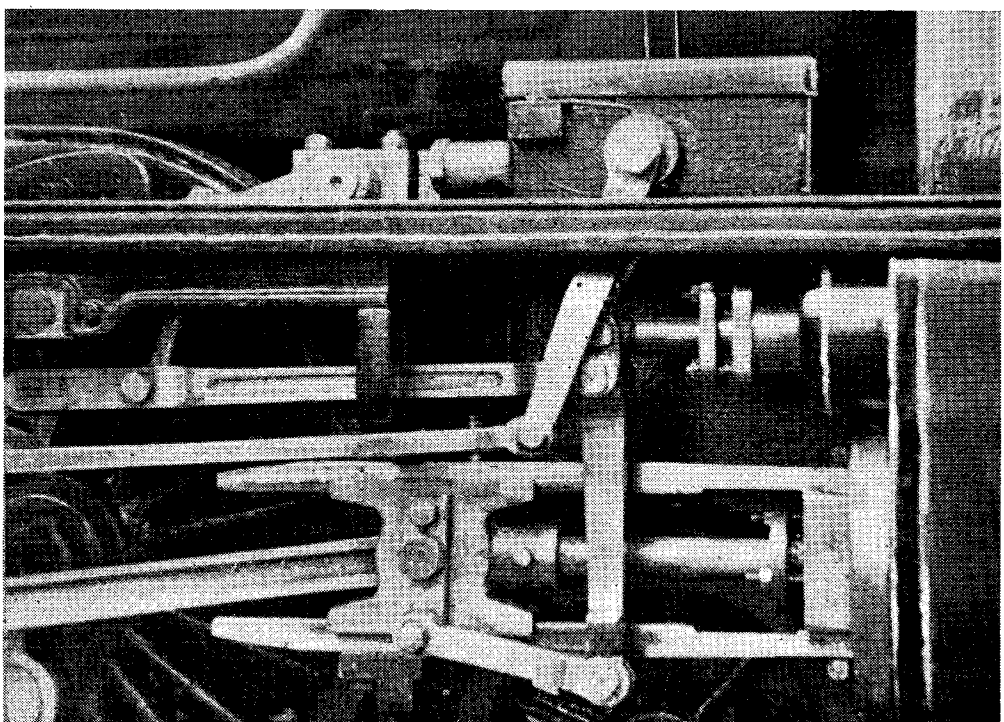
The boiler is built of copper throughout; the barrel is 4-in. diameter tube, 14-guage, firebox



Three-quarter view of scale model S.R. "King Arthur" type locomotive

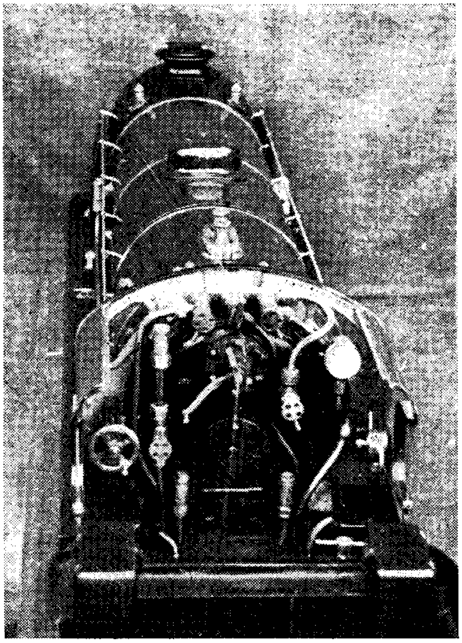


Near side view, showing true-to-scale motion



Off side view, showing lubricator drive (note studded glands)

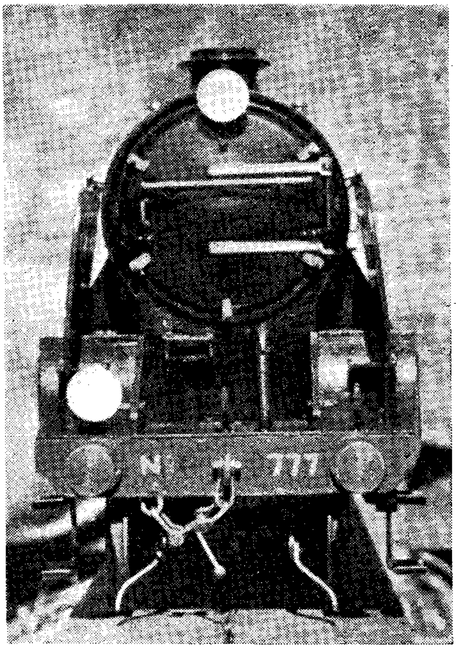
wrapper, inner firebox, door-plate, and throat-plate, 14-guage; front tube-plate and back-plate, 10-gauge; three $\frac{3}{4}$-in. superheater flues, and nine 7/16-in. firetubes. The flanging of the various plates was done over formers.The whole assembly was riveted up and brazed with "Easyflow" silver-solder, with the aid of the 5-pint blowlamp. There are two longitudinal stays, 3/16-in. diamerter, one of which is hollow to admit steam through to the blower which, by the way, is of the ring-type. All firebox stays are 5/32-in. diameter and are nutted inside. The boiler was tested to 200 lb. per sq. in. water pressure, afterwards 130 lb. per sq. in. steam. The working pressure is 100 lb. per sq. in. The superheater elements are $\frac{1}{4}$-in. spearhead; the wet header accommodates a rustless ball-valve, which is connected by two pipes to the scale type snifter-valves on smoke-box and work quite satisfactorily. Smokebox is of copper; front and back rings and door are castings. The boiler is covered with asbestos held in place by a steel cleading with the usual boiler-bands. An "L.B.S.C."—type mechanical lubricator is fitted on the off-side foot-plating, and is driven off the valve-motion. Twin boiler-feed pumps, eccentric-driven, have $\frac{3}{8}$-in. rams.



Cab view, with roof removed

The boiler fittings include two safety-valves, one set at 100 lb. pressure the other, a little higher; two wheel-valves; water-gauge, 3/16-in. glass, with blow-down; blower-valve, blow-off cock; whistle-valve, with whistle under foot-plate, and pressure-gauge, reading 0-150 lb.

The throttle is of the disc type with scale regulating handle. Two clack valves, one at front end of boiler, off-side one for tender hand-pump feed, the other one in the near-side for admitting air to boiler for steam-raising, are fitted. There are two clacks on the backhead, one for eccentric-driven pumps, the other for injector,



The front end

which has yet to be fitted; these two clacks, by the way, discharge the water away from the inner firebox plates.

All footplates and cab were cut from 18- and 20-gauge steel, and the cab roof slides off for ease of manipulation.

The tender is of the two-bogie type, with wheels $2\frac{3}{8}$-in. diameter on tread; the bogie side-frames were cut from $\frac{1}{8}$-in. steel-plate, stretchers, horns, axleboxes and laminated springs are castings, 1/16-in. snaphead rivets were used to hold the parts together, a small coil spring is fitted between cast spring and axlebox, the main frames of tender are $\frac{3}{4}$-in. $\times$ $\frac{1}{4}$-in. section, held together by bogie pin stretchers and buffer beams which are strongly angled together.

Body and soleplate are 20-gauge hard-rolled brass sheet; it encloses hand-feed boiler-pump, by-pass from engine pumps, and water-valve for same, and injector. Brakes are fitted to all wheels and are fully compensated and controlled by hand-screw. Tool boxes are fitted with proper hinged lids, which open. Buffer-stocks are castings; the buffers themselves were turned from large steel bolts, and are fully sprung.

All handrails and knobs are of rustless steel. The complete loco is painted and lined as was

the prototype; it is my first attempt at lining and lettering, and is probably not quite as it might be; but nevertheless it improves the appearance immensely. I have not got a suitable nameplate for it, but I think the engine carrying the same number was *Sir Lamiel*. The smoke-deflectors are made detachable.

I have no suitable track available at present, but have had the engine under steam on the bench, and it seems to give a good account of itself. Approximately 1,500 hours have been spent on its construction, involving some hard work at times.

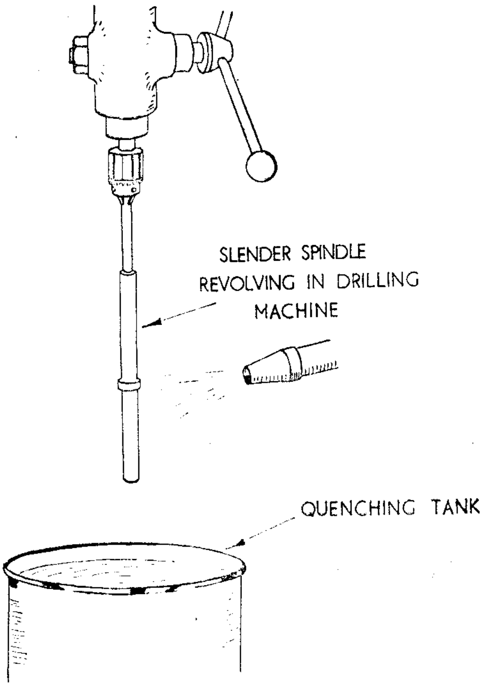
Three parts of the turning was done by turning the lathe by hand, including all fittings for boiler, valve-gear pins, cylinder covers, some eight dozen hexagon-head steel bolts, bushes, etc., because when I took up my present residence I had no power to drive my lathe.

All the castings and drawings were supplied by Mr. H. P. Jackson, who is well-known for his fine workmanship.

Hardening and Tempering Carbon-Steel

by M. Hall

CARBON-steel, at its normal temperature has, as its chief hardening ingredient, a chemical called pearlite carbon. When the steel has been heated to a temperature for hardening, the pearlite changes to a hard carbon, and is retained in this state by quenching. That is, very briefly, the chemical change which takes place in all steel hardening.



Prior to heat treatment, it is as well to remove any foreign matter from the face of the steel, such as scale, paint, etc. The next step is to release all the internal stresses caused by its manufacture. This is done by heating the steel to a cherry red, soaking in heat until the colour is uniform, and then allowing to cool in ashes or lime.

For hardening steels of say, .75 per cent. carbon, heat slowly until it appears cherry red, whilst for steels of around 1.5 per cent. heat to a slightly darker red. The flame of the furnace or hearth should have as little air in it as possible, as air in contact with the heated steel causes local de-carbonisation and soft spots. Cold tongs also cause soft spots, so heat these before gripping the job.

Have the quenching bath near to the furnace, and if possible, have the water temperature about 65 deg. F. When quenching, plunge the job well under water and agitate so that it will cool as quickly as possible. To get extra hardness, brine is a good quenching medium.

When the job is cool it should be dried, and polished with emery cloth or a buffing wheel in preparation for tempering. For tools such as punches, lathe tools, etc., heat should be applied a little way from the cutting edge, and when the correct colour has arrived, the tool should be quenched. For tools requiring uniform hardness, a good plan is to suspend the job on a piece of wire, and pass it through the flame, at the same time moving it about so as to present all faces to the heat in turn.

Long slender jobs often present some difficulty due to distortion and bending during hardening. One method, which will obviate this to a large extent, and which I have used successfully on slender spindles, is to grip the job carefully in the chuck of a drilling machine, set the machine going and apply heat to the job with a torch set on the "gassy" side. By placing a tank of water beneath, quenching can be done by lowering the job by the machine feed handle.

COLOUR	°FAR.	SUITABLE FOR
PALE YELLOW	430	SCRAPERS. LATHE TOOLS.
STRAW	460	MILLING CUTTERS. SCRIBERS.
DARK YELLOW	490	TAPS. DIES. PUNCHES. REAMERS.
BROWN PURPLE	520	DRILLS. PRESS TOOLS.
LIGHT PURPLE	540	CHISELS.
DARK PURPLE	550	SCREWDRIVERS.
BLUE	560	BRADAWLS. BANDSAWS.
DARK BLUE	570	SPRINGS.

When quenching one of those awkward jobs of unequal cross sectional area, try to enter the large mass into the water first and cool equally.

The tempering chart will give an idea of the colours required for commonly used tools.

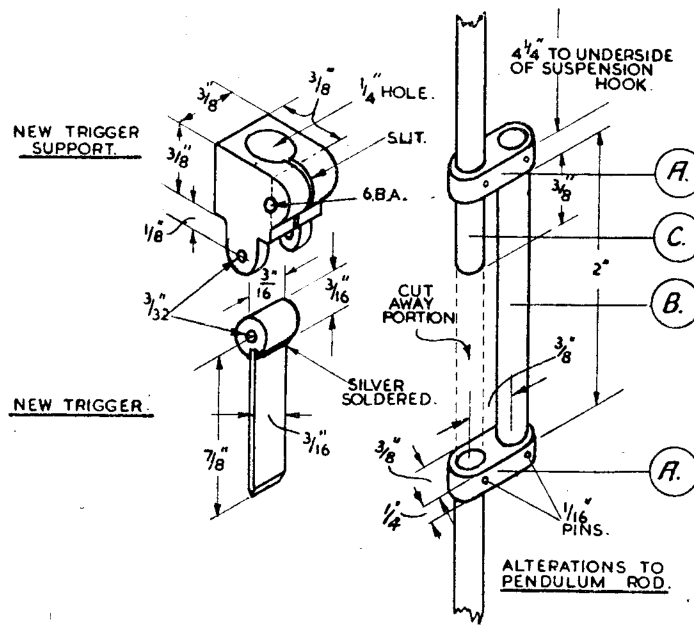
Notes on "A Battery-Driven Electric Clock"

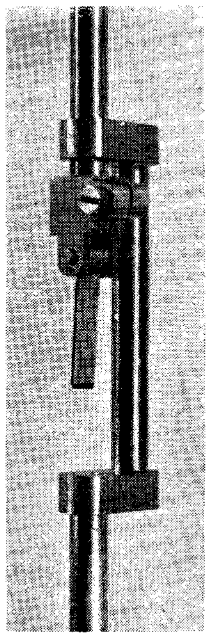
by C. R. Jones

THE writer of the above article, published in the January 26th, February 2nd, 9th, 16th, and 23rd 1950 issues, having had several letters from interested readers, mainly asking for further information, hopes the following notes will be of help and interest.

(f) The lower end of trigger, also trigger block *must* be hardened.

(g) The short *effective* length of pendulum suspension spring, viz: $\frac{3}{16}$ in. should be adhered to, as this is designed to prevent pendulum twist as much as possible





Some have had trouble in getting the pendulum to work satisfactorily, mainly, it seems, owing to the contact-maker not functioning as it should do, the trigger tending to slip off the trigger block on what should be the contact swing of the pendulum, making the contact spring assembly vibrate badly, and also causing the pendulum to dither.

The writer does not claim never to have had this trouble, but thinks that the present design of the contact spring assembly and trigger has practically done away with it, provided that the work has been carried out accurately.

The following points are very important :—

(a) The clock *must* be securely fixed to wall.

(b) The trigger *must* be free on its spindle.

(c) The trigger *must* be sharp at its lower end.

(d) With the pendulum at rest, the lower end of trigger *must* be parallel with "V" notch in trigger block.

(e) The top edges of "V" groove *must* be sharp.

(h) With the pendulum at rest, the armature and the magnets should be square with the baseboard.

When the above mentioned trouble has occurred it has been found that it was mainly due to the trigger resting on *top* of the left-hand top edge of the "V" groove and then slipping off, hence the importance of items, *a*, *b*, *c*, *d*, and *e*.

One reader wrote about what he called the "dead end effect," this being a loud thump occurring when contact was made, and the magnet energised.

I have also experienced this trouble, and think that it is due to the wrong timing and length of impulse, and can be corrected, by means of the contact adjusting-screw in the pillar *B*, and also by the stop-piece in the pillar *A*.

It is suggested that as an improvement, the $\frac{1}{8}$-in. hole in this latter pillar should be tapped out to, say, No. 3 B.A. and a suitable brass screw

fitted instead of the silver-steel. This will enable this top adjustment to be much more accurately and easily carried out.

As a preliminary, the contact spring assembly should be adjusted by the stop in the pillar *A* to lie horizontally, and the trigger support adjusted so that the lower end of the trigger is resting on the bottom of the "V" groove with the right-hand side of the armature, about, say, $\frac{5}{8}$ in. away from the left-hand side of the magnet poles.

The pendulum should then be moved slowly by hand to the right, until the contacts close, which should take place when the right-hand side of the armature has nearly reached the left-hand edge of the magnet poles.

Continuing the movement, the contacts should open again, just before the armature reaches its lowest position.

The above should be a good guide, and by using the adjustments provided, it should be possible to get the pendulum working satisfactorily and to do away with the thump, at least so that it is very slight, and nothing to worry about.

The position of the trigger block on the contact spring assembly determines the length of swing of the pendulum; if it is moved to the left the swing increases, and vice versa.

The battery operating the writer's clock has been in operation since the middle of July, 1949, and drives the pendulum for $1\frac{1}{2}$ min. between contacts at present, and is still going strong.

Since the article was written, some alterations have been made to the pendulum-rod, and a crank has been put in it, as will be seen on the accompanying drawing and photograph, to enable the trigger to work dead in the centre-line of the pendulum-rod, and prevent twisting movement to the pendulum when contact is made.

Two pieces similar to small crank-webs were made from $\frac{3}{8}$-in. $\times$ $\frac{1}{4}$-in. mild-steel, two pieces being cut off and sweated together. They were then marked off and two holes drilled slightly under $\frac{1}{4}$ in. diameter at $\frac{3}{8}$-in. centres, and reamed out to $\frac{1}{4}$ in. diameter. The ends were then nicely rounded, and the two pieces were unsweated and cleaned up.

A $2\frac{1}{2}$ in. length of $\frac{1}{4}$ in. diameter mild-steel *B* was next fitted through the two rear holes, and drilled and pinned with $\frac{1}{16}$ in. diameter pins as shown, and with the pendulum-rod stripped of all but the suspension hook, this assembly was threaded on until the top surface of piece *A* was $4\frac{1}{4}$ in. distance from the underside of suspension hook, and carefully set on rod so that piece *B* would be directly behind the main pendulum-rod when it was hung in position on the suspension spring. The pieces *A-A* were then drilled, together with the pendulum-rod, for the $\frac{1}{16}$ in. diameter pins and carefully riveted in position.

The whole was sweated together and cleaned up, after which the portion of pendulum-rod was cut away where shown, leaving a piece $\frac{3}{8}$ in. long *C* for the new trigger support to clamp on.

A new trigger support was made from $\frac{3}{8}$-in. square brass rod, which was set up truly in the four-jaw chuck, faced off, centred and drilled for a depth of $\frac{3}{8}$ in. and to $\frac{1}{4}$ in. diameter. It was then removed from the chuck, and the forked-end cut out, the distance between the forks being $\frac{3}{16}$ in., a 3/32 in. diameter hole being drilled through both forks to accommodate the pin for the trigger to work on.

As there was not enough metal to take a clamping-screw, a $\frac{3}{8}$ in. length of $\frac{5}{16}$ in. diameter brass rod was cut in half length-wise and silver-soldered on where shown by the dotted line on the drawing, and was afterwards drilled, and the rear portion, after being slit with a hacksaw where shown, was tapped No. 6 B.A., the forward end being drilled to clearance size. It was then fitted with a No. 6 B.A. set-screw.

A new and lighter trigger was made up from a $\frac{3}{16}$ in. length of $\frac{3}{16}$-in. brass rod, which was drilled to accommodate a 3/32-in. pin, and had a small slit cut as shown to take the piece of softened hacksaw blade, which was afterwards silver-soldered into position, the end being sharpened and hardened.

This alteration to the pendulum-rod necessitated the shortening of the three pillars *A*, *B* and *C*, and they were set up in the lathe and $\frac{3}{8}$ in. taken off their lower ends.

The adjustments after this alteration are the same as before, and the clock seems to be behaving quite well. The alteration was not really considered necessary, as the clock worked perfectly well before, but it was thought to be more correct for the centre-line of the trigger to work in the centre-line of the pendulum-rod.

Some readers have asked about the 12-1 gears, which drive the hour hand. As was stated in the article, the ones on the mechanism described were copies from a set which originally came from an old alarm clock. These were measured up and blanks made, and were cut with a small cutter frame with a fly-cutter, carefully filed to the shape of the tooth space and hardened and tempered. This was driven at a very high speed by means of a small motor.

The pinion on the centre spindle had 12 teeth, and drove a wheel containing 36 teeth, which had a 10-tooth pinion attached to it, which in turn drove the wheel with the pipe or cannon for the hour hand, and this wheel had 40 teeth.

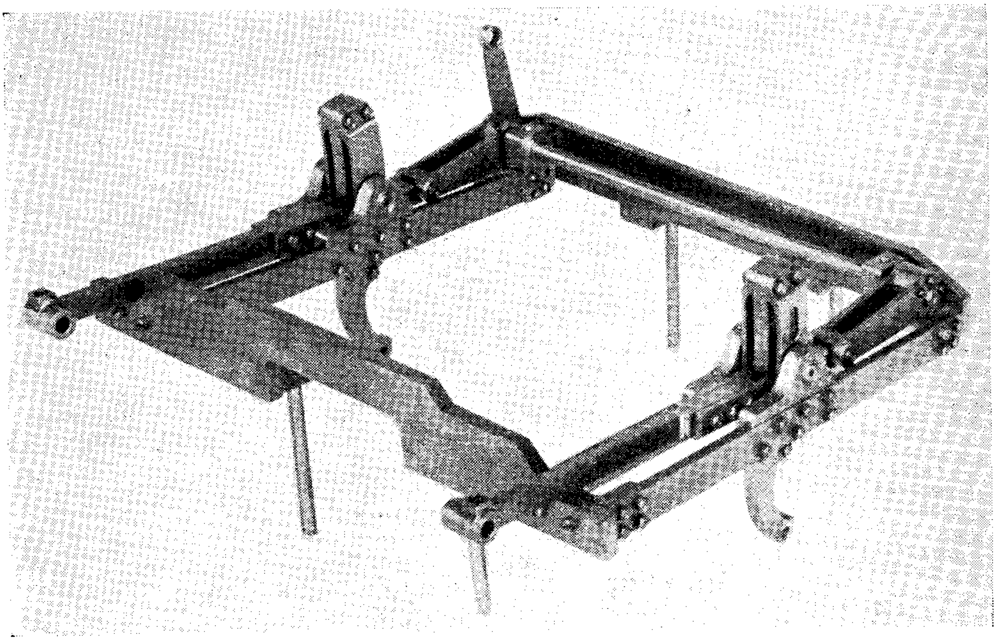
The diametrical pitch of the wheels appeared to be 38, the diameters of the various wheels being: The pinion with 12 teeth, 0.368 in. in diameter; 10 tooth pinion, 0.316 in. in diameter; the 36-tooth wheel 1.00 in. in diameter, and the 40-tooth wheel 1.1052 in. in diameter.

I have made gears using Meccano gears as patterns for filing up the cutters, as these appear also to be 38 diametrical pitch, and by making two cutters, one for the wheels and one for the pinions, it is possible to make a set of gears that will work, even if they are not quite correct in tooth form. After all, the motion wheels which work the hour hand in a clock need not be so terribly accurate, as long as they work freely, and by these methods they can be made without a lot of elaborate equipment and expense.

It is hoped that the foregoing will help to clear up some difficulties readers may experience in the making of this clock.

Blobs and Gadgets by "L.B.S.C."

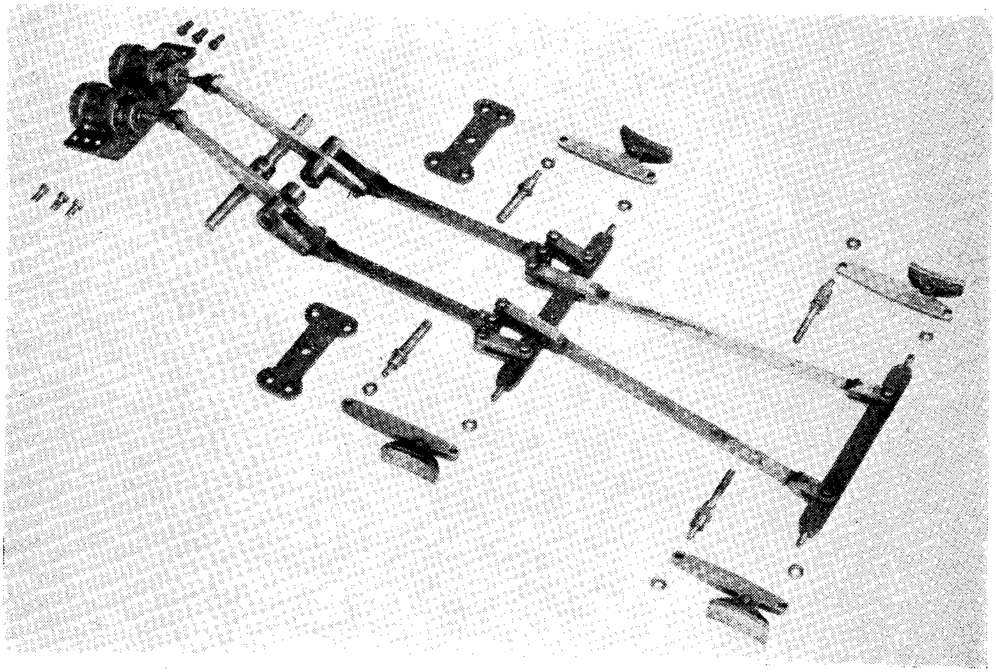
ANYBODY looking at a little locomotive, and unfamiliar with the construction and the amount of fiddling work entailed in same, hasn't any conception of the number of little bits that are embodied in its make-up. Even we who build them, make the parts and put them together without actually realising the amount of work involved—it is said that one can get used to anything !—unless, for some reason or other, we pull the whole shebang to pieces, and lay out the parts. Then we get a shock, and wonder how on earth we did it. Just recently, Al Milburn pulled his cut-from-the-solid Atlantic engine all to pieces, for the express purpose of taking a series of close-up photographs of the component parts, and sent me some copies. Thinking they might be of interest to followers of these notes, several are reproduced here ; and they not only show the conglomeration of oddments that constitute the engine, but illustrate the quality of our friend's workmanship, which gained the highest commendation from the very much lamented master-craftsman, the late Dr. J. Bradbury Winter.



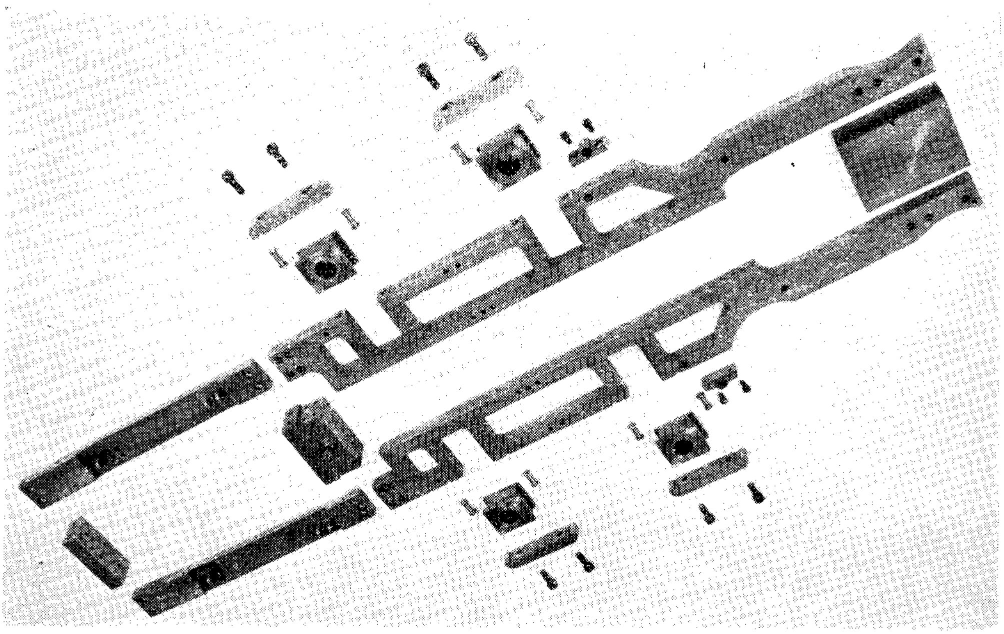
Valve-gear unit

There is no need to go into detailed explanations as the pictures speak for themselves ; there are a few points well worth noting. The American type bar frames are rather more laborious to cut out than British plate frames ; but, *per contra*, there are no hornblocks to fit, the frames being thick enough to take the pull and thrust of the axleboxes without needing additional bearing surface. The pilot-beam is a bit more hefty than its British counterpart, the buffer beam; and the adornments, viz. automatic coupler, coupler pocket, operating gear, pillars and sockets, and pilot (what the kiddies call the " cowcatcher ") require more skill and labour than two spring buffers and a screw-coupling. The springs, plus the fully-equalised rigging, certainly called for plenty of care and patience ; so did the brake-gear, which is interesting by virtue of being operated by two cylinders. Incidentally, some of the vacuum-braked Maunsell engines on the Southern Railway, had two cylinders, as a single vacuum-operated cylinder capable of giving the requisite braking power, would have been too big to accommodate under the trailing end ; one reason why the majority of locomotives have steam brakes on the engine and vacuum equipment for the train only. One operating handle does the needful.

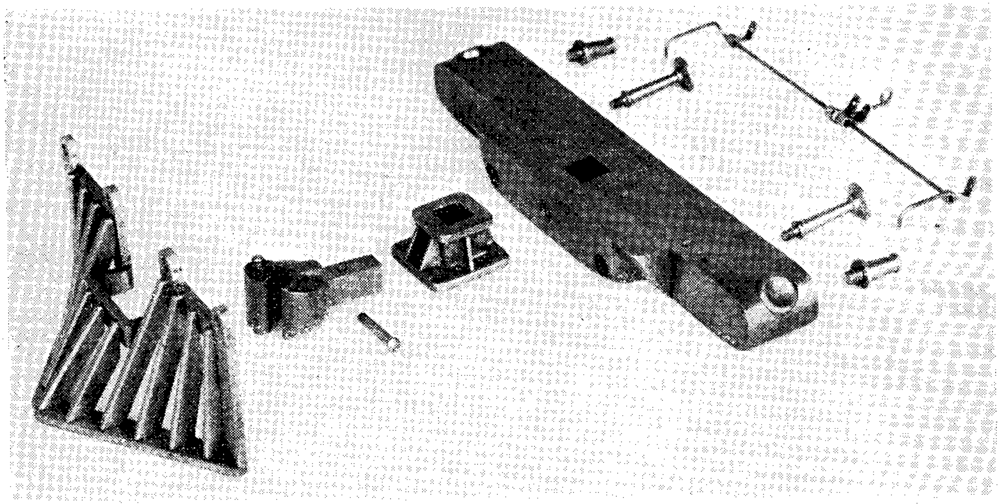
One advantage of American type construction is shown in the view of the Walschaerts link assembly ; the expansion links, complete with trunnions and bearings, radius-rods, reverse-shaft and lifting-arms, are all made up and assembled as a single unit, which is easy to erect on the main frames, and can be taken off and replaced by a new or reconditioned unit, when badly worn, or damaged in any way. The little one shown, is a nice piece of work, and our friend



Brake gear



Frames and axleboxes

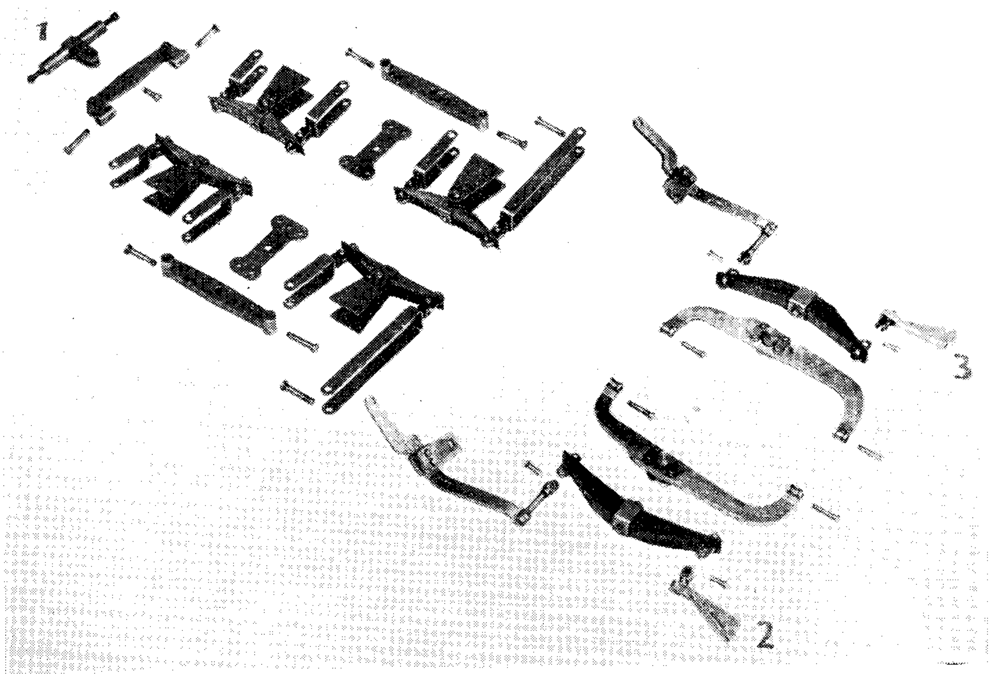


Pilot, beam and coupler

across the big pond certainly deserves commendation for his skill and patience.

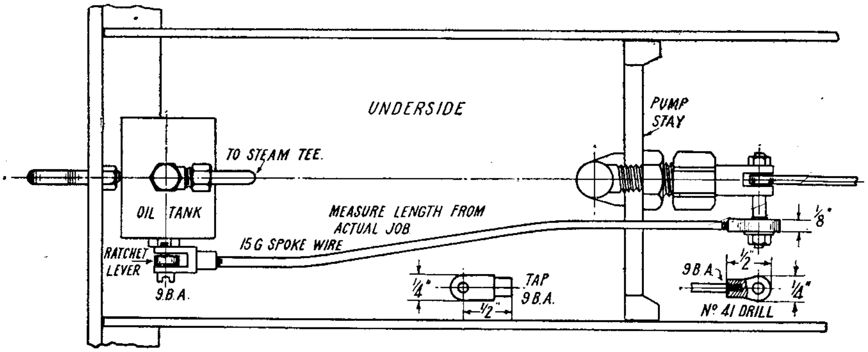
Beginners' Corner (contd.). Lubricator Drive for "Tich"

When making the water pump for our little shunting pug, we fitted a special wrist-pin, or gudgeon-pin, to the end of the ram, with an extension at the side for driving the oil pump; so all that remains to be done, is to connect this to the ratchet lever, so that the latter will waggle, as the ram moves back and forth. The connection is made by a piece of 15-gauge spoke-wire, slightly offset, with suitable connections at each end. The eye at the pump end is filed up from a bit of $\frac{1}{8}$-in. brass plate, or from $\frac{1}{8}$ in. $\times$ $\frac{1}{4}$ in.



Spring rigging

flat rod, to the shape shown ; the exact size doesn't matter. Drill a No. 41 hole in it, to fit nicely over the extension of the wrist-pin. Drill the end No. 53 for about $\frac{3}{16}$ in. down, and tap it 9 B.A. The fork at the other end, is made by exactly the same process previously described in full, for the valve-spindle forks ; so beginners can make use of their acquired knowledge, and I won't have to repeat the rigmarole. Make the fork to the given size, from $\frac{1}{4}$ in. square rod—copper tube, with a union nut and cone on each end, as illustrated in a previous instalment. Beginners should make these union nuts a dozen or more at a time, as they are needed for all pipe connections ; and if done the following way, they can be turned out at the rate of a minute apiece. I have given the instructions before, but they will bear repeating for new readers' and beginners' benefit. For $\frac{1}{4}$ in. × 40 unions, you need a piece of $\frac{5}{16}$-in. hexagon brass rod ;



How to drive the lubricator

either brass or steel will do equally well—slot is a full 3/32 in. wide and $\frac{3}{8}$ in. deep, to accommodate the end of the ratchet lever easily, and the stem is drilled No. 53 and tapped 9 B.A. Note—drill the fork No. 53 before slotting ; then tap one side 9 B.A., and open out the other side with No. 48 drill, after finishing. Make a 9 B.A. screw from a bit of $\frac{3}{16}$ in. silver-steel, same as valve-gear screws, and leave enough " plain " under the head, to clear the end of the ratchet lever, and allow the screw to be driven right home without squeezing up the jaws of the fork. This screw is better than a bolt, in the present instance, as it allows of instantaneous disconnection when taking off the lubricator to clean it out, or for any other purpose. An occasional " birthday treat " does the lubricator a world of good, and prevents blockage of the weeny ports, also from minute particles of grit or other unwelcome substance, getting under the clack-balls and allowing steam and water to get into the oil pipe.

The length of the rod is found from the actual job. Set the ratchet-lever vertical and put the pump ram at half stroke. Bend the piece of cycle-spoke as shown, and also set it to clear the pump stay ; then cut to required length, allowing a full $\frac{1}{4}$ in. at each end, for screwing into the eye and the fork. Put about $\frac{3}{16}$ in. of 9 B.A. thread on each end, screw on the eye and fork, and erect as shown. The ratchet should click one tooth for every revolution of the wheels. If it doesn't do this with the fork connected to the bottom hole in the ratchet lever, shift the fork up higher until it does.

Mass Production

The union on the check-valve under the lubricator is connected to the union under the cross steam pipes, by a bit of 3/32-in. or $\frac{1}{8}$-in. a centre drill (size E) No. 30 drill (for $\frac{1}{8}$-in. pipe) 7/32-in. drill, and $\frac{1}{4}$-in. × 40 plug tap. If your lathe has the ordinary screw tailstock, put a tapwrench on the tap, right close to the flutes. If the tailstock is not graduated, put a stop on the 7/32-in. drill, a bare $\frac{1}{4}$ in. from the end of the lips ; this is just a little collar made from $\frac{3}{8}$-in. brass rod, with a 3/32-in. set-screw in it. If you have good eyesight and a sensitive touch, merely a mark on the drill would do, or a ring of wire around it, just sprung on.

First operation is to part-off your blanks ; put the rod in the three-jaw, with about $\frac{5}{8}$ in. projecting, then put a parting-tool in the rest, and set it to cut off $\frac{5}{16}$ in. of the rod. Put another piece of rod in your tailstock chuck—any bit handy will do—run up the tailstock until the rod hits the piece in the three-jaw, then tighten the clamp. Now part-off ; release chuck jaws, pull out the rod until it hits the bit in the tailstock chuck, tighten up, part-off again, and ditto repeato until you have the required number of blanks. You can do the whole lot in less time than it takes me to write these instructions.

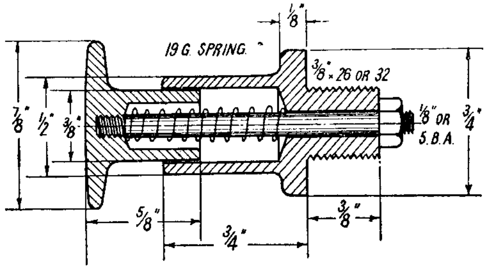
Now lay out your weapons of offence on the lathe tray or bench, in the order set out above. Put a chamfering tool in the slide-rest ; that is, a square-ended tool with the left-hand corner ground off at an angle of about 45 deg. The tool should be backed off below the angle, so that it will cut at the side, and act as a facing tool as well. Pop a blank in the three-jaw ; put the centre-drill in the tailstock chuck, and centre the blank ; drill it right through with the No. 30 ; poke the 7/32-in. drill in, as far as the stop, or mark ; then apply the tap, just tightening the tailstock chuck sufficiently to allow the tap shank to slide, whilst you hold the tapwrench to prevent it turning. Pull the belt by hand, whilst tapping. Finally, chamfer the corners with the tool in the

slide-rest; then reverse the nut, and chamfer the other end—finis Johnny! The rate at which you can turn out the nuts, depends entirely on how quickly you can change the drills and tap in the tailstock chuck. The ideal set-up for a beginner would be to have a turret attachment for the tailstock, which would carry the drills and tap. I have one; gave 17s. 6d. for it at George Adams's old shop in Holborn, soon after the end of the Kaiser's war. Goodness only knows what one would cost now! However, I seldom use it, unless I make (for example) a batch of injectors, and want about half-a-gross or so of nuts; seem to have developed the habit of changing drills, taps and reamers in an "unconscious" manner, just like the girls at the old munition shop used to do. As one gets toward the end of the run over the Great Railroad of Life, the minutes seem absolutely to fly; so the only thing to do, is to speed up as much as possible, and fly with them. Maybe it is only fancy; a locomotive or a motor-car, seems to go ever so much faster at night, yet it takes the same time between stopping points! Still, there it is, as the farmer said when he spotted the Colorado beetle among the "praties."

How to Make Union Cones

Most beginners will probably have seen the commercially-made unions illustrated in the catalogues of various firms, in which the nut is plenty big, and has a separate "lining," as the male or coned part of the union is known in the trade. For a $\frac{1}{8}$-in. pipe, the lining will have to be $\frac{3}{16}$ in. diameter at least, as the pipe fits into it. This necessitates a cone over $\frac{1}{4}$ in. diameter at the base, or widest part, and this in turn means a hexagon nut at least $\frac{3}{8}$ in. across the flats. Well, I've had a fair amount of experience with full-sized engines, but I don't recollect ever seeing a hexagon nut 6 in. across the flats, on an oil pipe! The few who have seen my locomotives "in the flesh," and the many who have seen close-up photographs of the working parts, have always remarked on the neatness of the "plumbing," especially the small unions. The reason for this, is the complete elimination of the separate union lining. I always put the cone straight on the end of the pipe, and this enables a much smaller nut to be used. It is quite possible to use a nut only $\frac{3}{16}$ in. across the flats, to couple up a 3/32-in. pipe. However, so as not to make it too fiddling for our tyro friends, we will use the size of nut described in the paragraph above. Cones to suit these, are made from 7/32-in. round rod. This should be copper, if it is available; a copper cone beds in steamtight, without much tightening of the nut, and the risk of stripped threads. If 7/32-in. rod isn't procurable, use $\frac{1}{4}$ in. and turn it to size, so that it will just slip in the nut.

This is where the four-tool turret comes in handy. All home-workshop lathes should be provided with them as standard fittings. I made my own. It should be furnished with round-nose, knife, combined facing and chamfering (as above) and parting-tools. The chamfering tool should have the corner ground off to such an angle that it matches up exactly with the lathe centre-point, or to the angle of a centre-drill held in the three-jaw. Then all you have to do, to make the cones, is to chuck the rod, turning to correct diameter if necessary. Face the end, centre, and drill down about $\frac{1}{2}$ in. depth with a drill suitable for making a tight-fitting hole for the pipe; say No. 42 for 3/32-in. pipe, and No. 32 for $\frac{1}{8}$-in. pipe. Feed the chamfering tool "straight at it," coning the end sufficiently to enter the countersink on the check-valve connection; don't run the lathe too fast, and apply a drop of cutting oil with a brush. Part off about $\frac{1}{16}$ in. behind the taper part, and there is your cone. Make a dozen or so at the time. If you haven't a four-tool turret, cut several short pieces of rod, chuck each, face and drill both ends of each, then set up your chamfering tool, form all the cones, and finally set up your parting-tool and part them all off.



Section of buffer

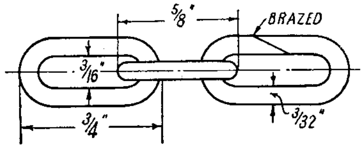
Cut a bit of tube to reach from the check-valve union on the cross pipe fitting, to the clack under the lubricator; put the "piggy's tail" in it, as shown in the before-mentioned illustration, to provide flexibility. Put a union nut on each end, then a cone; silver-solder the cones, using the weeniest amount of silver-solder; pickle, wash, and clean up, screw the nuts on, and another job is completed.

Buffers

We might as well fit the buffers and couplings before starting on the boiler, as the couplings, at any rate, will be needed for testing. The guard-irons, and the brake-gear, can be left until "the final." Some good folk seem to be under the impression that I leave out or forget brake-gear when designing, and add it as an afterthought, which proves they know little about Curly methods. My experience of small locomotive builders teaches me one fact, viz. that they would rather get the locomotive on the road, and see the wheels turn, and experience the pleasure of driving it, than spend months, or maybe years, adding what I call "trimmings." I therefore describe the fundamentals first; those who desire, can then doll up the engine as much as ever they desire, meantime having it in working order, to arouse renewed interest whenever they are in danger of getting "browned off."

Our approved advertisers will probably supply castings for the buffers; bronze or gunmetal for the sockets, and nickel-bronze (German silver) for the heads. They can, of course, be made from rod material; brass would do quite

well for the sockets, and steel for the heads. Old bolts make swell buffers ; young Curly used them—trust that worthy to press any mortal thing into service ! A very shallow pocket proved the finest possible incentive to improvisation. It amused my mother no end, when I begged the brass screwed stopper of the domestic kerosene can, for the chimney cap of a little " Brighton " engine ; it was the right shape and size, and the cork I gave her in exchange, suited the can just as well as the brass cap. With the turning and fitting experience they have now acquired, beginners shouldn't have the slightest difficulty in making the buffers straight from the drawing. Chuck the socket by the spigot, turn the outside to shape, face the end, centre, drill right through with No. 30 drill, and open out to $\frac{5}{8}$ in. depth with $\frac{3}{8}$-in. drill. Reverse in chuck, turn the spigot to $\frac{3}{8}$ in. diameter, face the back (says Pat) of the flange, screw the spigot $\frac{3}{8}$ in. × 26 or 32, and cut back to $\frac{3}{8}$ in. length.

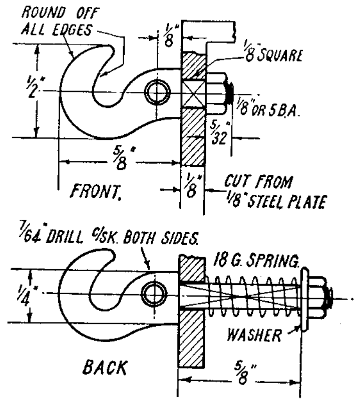


Coupling links

The heads will probably be cast together, " head on." Chuck by one end, turn to a sliding fit in the socket, face the end, centre, drill to $\frac{3}{8}$ in. depth with $\frac{1}{4}$-in. drill, drill a No. 40 hole at the bottom of the recess, about 5/32 in. deep, and tap it $\frac{1}{8}$ in. or 5 B.A. Reverse in chuck, repeat operation on the other end, then part in the middle. Chuck each piece by the stem, and turn the head to shape and size shown. The spindles are $1\frac{5}{8}$ in. lengths of $\frac{1}{8}$-in. round steel, screwed at each end for $\frac{3}{16}$ in. or so ; the springs are wound up from 19-gauge steel wire, and the whole assembled as shown. Poke the shanks through the holes in the beams, and secure with nuts made from $\frac{3}{16}$ in. slices of $\frac{1}{2}$-in. hexagon rod, drilled and tapped to suit the shanks. The L.B. & S.C. Rly. engines had these hollow-headed buffers, as it gave the springs greater flexibility (they used volute springs) and, wonder of wonders, Hobden described a hollow-headed buffer in the *Boy's Own Paper* nearly sixty years ago ! To make buffers from rod material, simply cut pieces of suitable sizes of rod to required length, and proceed as above.

Couplings

The coupling-hooks are filed up from $\frac{1}{8}$-in. steel. What I usually do, is to mark the outline on a bit of steel left over from frame making—I save the larger scraps—then drill a hole slap in the middle of the hook, sawing down to it, and finishing with a file. Be sure to round off all sharp edges, or they will cut the links. The leading hook only has a short squared part. To erect it, hold the nut between the oil tank and the buffer beam with a pair of long-nosed pliers (known as " Ally Slopers " in the railway shops) then insert the screwed end of the hook, and start the nut on the thread. If the nut is then turned with a small spanner, the hook will be drawn into place and tightly held. The other hook has a longer shank, with a spring on it, to cushion the sudden pull when the regulator is mishandled by an inexperienced driver. There is no need to set up the hooks in the four-jaw, to turn and screw the ends ; just file away the corners of the square, and round off with the file, " by eye." The die will do the rest. The spring for the back drawbar



Drawbar hooks

is wound up from 18-gauge steel wire, and secured by an ordinary commercial nut and washer as shown in the illustration.

The three-link couplings are made from 3/32-in. round silver-steel, and are just a simple exercise in bending ; the sizes are given in the drawing. The joints in the links may either be scarfed, as shown, or merely butted together ; whichever way you choose, don't forget to put one of the longer links through the hole in the coupling hook before closing the joint. Braze the joints by anointing with wet flux, blowing to bright red, then touching with a bit of thin brass wire, or commonest grade of silver-solder. Let them cool off naturally, otherwise the links will go hard and brittle, and would snap under a sudden jerk. They can either be polished up, hooks and all, or left black or blue ; it is very seldom a locomotive of this type has scoured-up hooks and chains ! Well, that will be all about the chassis for the time being ; now we will see about a suitable boiler. In response to requests, I propose (circumstances and the K.B.P. permitting) to give dimensions of two boilers ; one, to the size shown on the original drawing, and an alternative with a much larger barrel, to suit the wishes of some beginners who are rather doubtful about their efforts on " the works," and want to make certain of plenty of steam to make up for any inefficiency. Personally, I don't think they have any cause to worry, as the steaming capacity of all my boilers, has, up to the present, been more than enough to cope with every demand made on them ; but as I'm here to do my best to please as many as possible, I'll fall in with their wishes.

Queries and Replies

Enquiries from readers, either on technical matters directly connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed "Queries and Service," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of a specialist, or outside consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query, but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 9822.—The Geometric Chuck
L.E.P. (Milford)

Q.—Will you please explain what is meant by the term "geometric chuck," and the purpose of this appliance?

R.—This refers to a number of different types which have been very much used in the past for ornamental turning. It consists of a chuck, or, in some cases, only a chuck back-plate, incorporating means of moving the chuck, with the work which it holds, both radially and circumferentially for the purpose of producing geometric shapes or patterns. For instance, if the work is moved, say, 1 in. out of centre, a circle turned at this setting will be eccentric to this extent of throw. If now the chuck is indexed 1/12th of a circle at a time and a number of circles turned at the various settings, the result will be an interlacing pattern of twelve circles. This is just an elementary description of the possibilities of the device, but it will be clear that by elaborating the gearing and movements, an infinite variety of patterns can be obtained.

No. 9819.—Lighting from a Transformer
J. T. (Whitley Bay)

Q.—I want to use a heavy duty transformer, 230-250 volts 50 cycles to 50 volt 11 amps., to light four 12-volt, 20-30 amp., or eight 6-volt bulbs in parallel. Is this scheme likely to be cheaper than using several small bulbs on the mains voltage, and would there be sufficient power to light so many bulbs to their maximum brilliance? Would the mains have to be switched off each time, would the switching off of one bulb break the circuit, or would the transformer continue to use "juice" although the lights were out?

R.—The scheme that you propose in using the transformer to light a number of low-voltage lamps in series, is quite practicable, but it should be pointed out that you can only use lamps taking up to the maximum amount of current supplied by the transformer. Your suggestion to use lamps which consume 20 to 30 amps. from a transformer supplying only 11 amps. would overload the transformer, and if it did not cause breakdown, would result in a drop of voltage so that the lamps would not be properly energised. The small lamps will probably give quite sufficient illumination for your required purpose, but they cannot, under any circumstances, give you more than the illuminating efficiency of high-voltage lamps working on the equivalent wattage. Switching may be carried out on the low tension side of the transformer if desired, but it is generally better to put the switch on the high tension side, so as to completely isolate the transformer when it is not required for use. We think that this would be insisted upon by the electricity authorities on the grounds of safety. If left switched on, the transformer would always be using a certain amount of current, though this would be quite small when no load was taken off the output side.

No. 9827.—Piston Rings
T.R. (Swansea)

Q.—I am at present making piston rings for a large gas engine, and am at a loss to know how large the outside diameter should be so that when the ring is split it fits the bore perfectly without any visible gap at the joint. Is there a formula giving the amount of metal to cut out?

R.—We do not recommend the production of piston rings by methods available in the ordinary workshop, because of the precision required to make rings of the required accuracy for maintaining a gas seal in a high pressure engine demands specialised precision, and also special material which is not available in the ordinary way. The amount of expansion allowed on a piston ring will depend on several factors, including the working pressure, the width of the ring in relation to diameter and the elasticity of the material. We do not know of any formula which covers this matter. Modern practice in piston ring production favours the use of the hammered ring rather than relying entirely on the natural elasticity of the metal to produce a perfectly circular ring when in place in the cylinder.

No. 9823.—Dividing Gear
R.J.L. (Hereford)

Q.—I wish to graduate a micro' collar for my 4-in. Pools lathe to 125 divisions. Could it be divided by using the lathe change-wheels in compound? If so, please explain how calculation is made for future reference. The wheels I have available are: 96, 90, 78, 66, 60, 57, 42, 36, 33, 30 and two of 24 teeth.

R.—It will be extremely difficult to set up a compound train to calibrate the indices in 125 divisions with the available change-wheels. We are not very much in favour of using compound trains for dividing, as they introduce the possibility of considerable error due to backlash and possibly eccentricity or pitch errors of the teeth. A much simpler and more satisfactory method of obtaining a wide range of divisions would be to use a change-wheel in conjunction with a worm for dividing. In your case, the 60-tooth wheel could be used on the lathe mandrel meshing with a single start worm, and in conjunction with a 50- or 100-hole division plate, would give you the required range of divisions, also the majority of divisions likely to be required in normal engineering practice. Particulars of how to construct dividing gear for lathes are given in our handbook *Milling in the Lathe*, price 3s. 6d.

No. 9813.—An A.C. Induction Motor
E.A.W. (Sevenoaks)

Q.—I have an a.c. induction motor, the running coils of which are burnt out. The starting coils are intact. Stator, 32 slots, both sets of coils in same slots, 4 poles (8 slots) 3 coils each per pole, in slots 1 and 8, 2 and 7, and 3 and 6 respectively, 4 and 5 unoccupied, starting coils underneath running coils. On top of stator, a condenser is fixed, which is also OK on test. The rotor consists of a drum with a series of holes, and is 4 in. diameter by 2 in. wide. On rotor spindle is fixed a metal strip with two legs, and a pin with light spring, cap and round sliding disc. There are three terminals. I intend rewinding with same gauge wire, No. 21, and same number of turns, 56, 56 and 85. Can you tell me:—

(1) What purpose the condenser serves and how connected.
(2) How are the starting and running coils connected.
(3) What is the purpose of the pin and strip with two legs.

On the cut-out of starting coils there is a steel stamping, which has a raised bevelled part round spindle hole. It is bright and bears evidence of being in contact with revolving part, which is missing.

R.—We regret we are unable to give you any very definite information on this motor, as we are not familiar with this particular type.

(1) The purpose for which the condenser is generally fitted to an induction motor is to improve starting torque, and in such cases it is connected in series with the starting winding. In other cases, however, the condenser is permanently connected in the running circuit and serves to improve the running torque characteristics.

(2) The starting and running coils of the usual type of induction motor are connected in parallel, but under normal running conditions, the starting coils are disconnected as soon as the normal running speed is obtained either by a hand switch or, more commonly in modern motors, an automatic centrifugal switching device.

(3) The components mentioned would appear to be part of an automatic device for disconnecting the starting coils, but the available information is not sufficient for us to form any idea as to how this device operates, or to advise you regarding any parts which may be missing from this mechanism.

No. 9828.—Scotch- or Slide-cranks
T.R. (Swansea)

Q.—I have been involved in an argument with a friend as regards the Scotch-crank or slide-crank. He says it would not be very efficient in an engine on account of the high friction and inertia of the gear. I cannot see that it would make a great deal of difference, as the slide-crank is used a great deal in donkey pumps. In such a gear one would get simple harmonic motion and a correct phase relationship, and could also dispense with the usual type of slide-bars. The Scotch-crank would, in a manner of speaking, be a connecting-rod of infinite length, and the only bad points which I can see would be those of friction and inertia, but I don't see that they would be any greater than in an engine fitted with the usual type of crank, connecting-rod and slide-bars. May I have your opinion?

R.—The Scotch- or slide-crank is not favoured in modern engineering practice, as the sliding member or die-block introduces considerably more friction than the more usual connecting-rod, and inevitably, heavy wear takes place, with the result that the mechanism becomes noisy and a hammering, with eventual destruction of the working parts, is liable to take place. It is correct that this type of crank gives true harmonic motion, but the practical advantages of this do not outweigh the disadvantages. Slide-cranks are occasionally used in direct-acting reciprocating steam pumps where the only function of the crankshaft is to drive the flywheel and valve gear, but they are very rarely used in engines which have to transmit the whole of the power through the crankshaft.

No. 9821.—Fitting and Removing Shanks in the Chuck
A.W.P. (Larkshall)

Q.—Will you please explain the best way of removing Morse taper shanks from drill chucks, without mauling it to pieces or blemishing the body of the chuck? It would also be helpful if you could tell me how to fit a shank so that it stays put until it is required to be withdrawn, and a few words on "opening up" the various makes of chuck would be useful.

R.—We have generally found the best way to remove a taper shank from a drill chuck is to drill and tap the end of the shank for a set-screw,

then, if a piece of tube of the appropriate length is put over the shank and a thick washer put under the head of the screw, it is generally possible to remove the shank simply by screwing it up against the end of the tube.

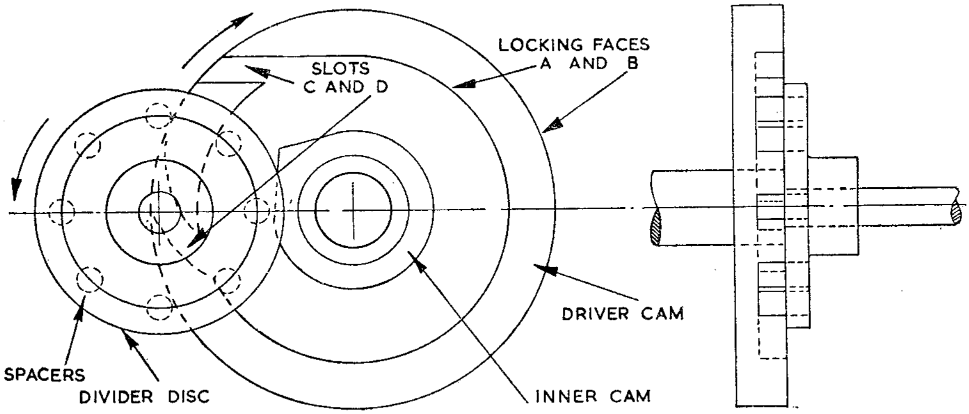
When fitting a shank to a drill chuck, it is quite a good idea to allow a short parallel portion between the tapered end parts, and cut a thread on this in such a way that a nut can be screwed on to press against the end of the chuck body and extract the shank in this way. In the matter of fitting chucks so that they hold securely, the one and only essential is that the taper should be accurate, and in this respect the use of marking colour, to make certain that the taper fits throughout its length, can be recommended.

Some types of chucks are made so that they cannot be dismantled, while others require the use of a fairly powerful press, which is not usually available in the small workshop. We have not been able to obtain exact details of the methods of construction of all the various types of chucks at present in use, and we have not found the makers very helpful in this matter, as apparently they do not encourage anyone to dismantle the chucks.

PRACTICAL LETTERS

Intermittent and Indexing Motion

DEAR SIR,—In reply to the query on the Powers intermittent movement in a recent issue, I submit a drawing and brief details of a similar intermittent motion which I developed a short time ago. The mechanical action is as follows: The inside and outside diameters *A* and *B* of the annular portion of the driver



cam pass between four of the spacers, thus locking the divider disc during its rest period.

The inner cam will move two of the spacers to enter the slots *C* and *D*, one from the inside, one from the outside, from thereon the slots *C* and *D* will complete operational cycle.

Yours faithfully,

Bristol 3. C. R. JETHN-JONES.

International Racing

DEAR SIR,—For several reasons I was highly pleased to read Mr. Moore's comments regarding my recent activities with an entirely purchased model race car, about which I wrote in THE MODEL ENGINEER, No. 2550, for it enables me to "fire the other barrel" as it were.

I had *purposely* avoided making any mention of the origin of the car in question, and dealt solely with the fact that it was purchased complete, in order to see if anyone would "take the bait" and bring up the other aspect of the situation.

As Mr. Moore has kindly obliged I now merely wish to add "Precisely—and that's where the second 'C' comes in"! "C"ash is generally necessary to a varying degree on the one hand, but a good "C"ontact is certainly no less useful when using this method of obtaining results, and fortunate indeed—in one respect—is the model car operator who has both!

With speeds ever on the increase it is no longer merely a question of running the best "standard" engine available, but one that has been "worked"—and by that I mean *improved*!—is often necessary to attain a winning performance, and if one is either not capable or not inclined to improve an engine then the better the second "C" the better the results should be.

By deliberately and—most important—*openly* using both in order to illustrate the situation, the car I purchased has put up the fastest speed at every meeting at which I have so far run it, and at the time of writing holds the British Open speed record at 115.5 m.p.h. It may not be without interest to state that not even the jet needle has been altered in the slightest, irrespective of the weather conditions and/or track diameter. Simply fill up with fuel and push it away—it would be difficult to do less. Need I say more?

I do not quite know why Bro. Moore troubles apparently to challenge the truth of "the first

time, etc.", and I can only suggest he reads to the end of the sentence without stopping for breath immediately after the word "time" where there is no comma. Actually what was intended to be conveyed was that the meeting in question was "competitive" and I assure Mr. Moore I had not the least intention of concealing the fact that the car had previously made one run at a "Meteor" practice meeting on a 21 ft. cable, and at a speed which would have been more than adequate to annex first place in the "Open" category at our annual M.C.A. competition had it not been decided to refrain from running it on that particular occasion.

With Mr. Moore's remarks about the M.C.A. I entirely agree, and take this opportunity of paying tribute to the hard work he has done during the last twelve months helping to put the constitution of this organisation on a sound basis.

Now that it appears fairly certain that many model car clubs *will* be providing a section for the "little-or-none-C. & C. fraternity" in their competitions, thus opening up the chances of a success to many who would otherwise never have a look in, I too, fervently hope that all model car competitors will be able to settle down. It was in the sincere belief that in this move lay the solution to the problem that made me strive so hard to attain it, and if time proves this belief to have been reasonably justified, I shall be very well content.

Tolerance, naturally, will always be necessary, but surely this does not mean that no attempt should ever be made to improve the lot of the—shall we say—not so "fortunate competitor who is minus either or both of those two "C" items which have such a profound effect on the sport.

Yours faithfully,
Stoke-on-Trent. F. G. BUCK.

Model Boilers

DEAR SIR,—I was very interested in the description in the June 8th issue of THE MODEL ENGINEER of a model Scotch boiler for a tug, as I have always had the idea that such a boiler was a practical type for a prototype model.

The only drawback that I can see is the probability of short runs only being possible between firings. A description of the behaviour of the boiler in use would, I am sure, be of great interest to readers.

One way of overcoming the firing difficulty, of course, would be to use an atomising oil burner, after the Blakeney pattern, which would still conform to prototype.

The only criticism I would like to make of the boiler described is the funnel arrangement, which, in my opinion, spoils an otherwise good model. If this arrangement was adopted to suit the position of the funnel in the tug, surely it would have been possible either to move the position of the boiler in the hull or even move the position of the funnel slightly fore or aft.

The usual arrangement, where only one boiler is installed, is for the front of the smokebox to slope outwards towards the top (not being parallel to boiler front as in model) so that the width at top is sufficient for the base of the funnel to be bolted direct to smokebox.

Also, it is more usual for the boiler feed to enter the boiler at one of the ends and not in the barrel portion as shown.

Another type of boiler which might be suitable for a prototype model is the cylindrical dryback type, which is very similar to a Scotch boiler except that the smokebox is at the opposite end to the furnace.

Although this type is not so efficient in full-size practice as the Scotch type, it might be more suitable for oil firing in a model, and is certainly easier to construct.

Yours faithfully,
Exmouth. "A.D.S."

An Unusual Turning Tool

DEAR SIR,—The article on the above subject was interesting to me because years ago, when I was out servicing mechanical switches, I carried a similar tool in my bag; but it was simply a block of steel, 2 in. $\times \frac{1}{2}$ in. $\times \frac{3}{4}$ in., with holes drilled in it: one in which the work-piece revolved, one in which a long piece of silver-steel was fitted and acted as a handle and tool-bit, the other hole was to see the tool cutting.

The work-piece was held in a hand brace, and it was simple to produce a highly accurate and concentric pivot on it to effect a repair, when the job was miles from a workshop.

This type of tool was used by the old clock-makers and I have used it for making screw blanks without a lathe.

Yours faithfully,
Wallington. C. L. BENNETT.

Blue Goggles

DEAR SIR,—It is true that there is no particular virtue in the colour blue as a protection for the eyes against ultra-violet radiation, but it is quite wrong to suppose that ordinary glass does not protect. The wavelength of light ranges from 75 millionths of a centimetre at the red end of the spectrum to about half that length at the violet end. Any radiation of shorter wavelength is ultra-violet, and those wavelengths most dangerous to man are between 20 and 35 millionths of a centimetre.

Any ordinary glass completely stops ultra-violet radiation up to about 35 millionths and if it is tinted any dark colour the added unpleasant effects of glare are avoided.

Because ordinary window glass absorbs ultra-violet radiation, people cannot become sunburned behind a closed window, unless it happens to be made of one of the special ultra-violet-transmitting glasses such as "Vitaglass." The lamps used for ultra-violet irradiation are made, not of glass, but of fused quartz, which transmits all the ultra-violet rays that can get through the earth's atmosphere.

Arc-welders and others using powerful sources of ultra-violet rays would risk serious damage to the eyes if they did not interpose a layer of common glass, and for any degree of comfort this glass should be strongly darkened.

Yours faithfully,
G. STRUAN MARSHALL.
Edinburgh. Group Captain.